SCIENTIFIC AMERICAN

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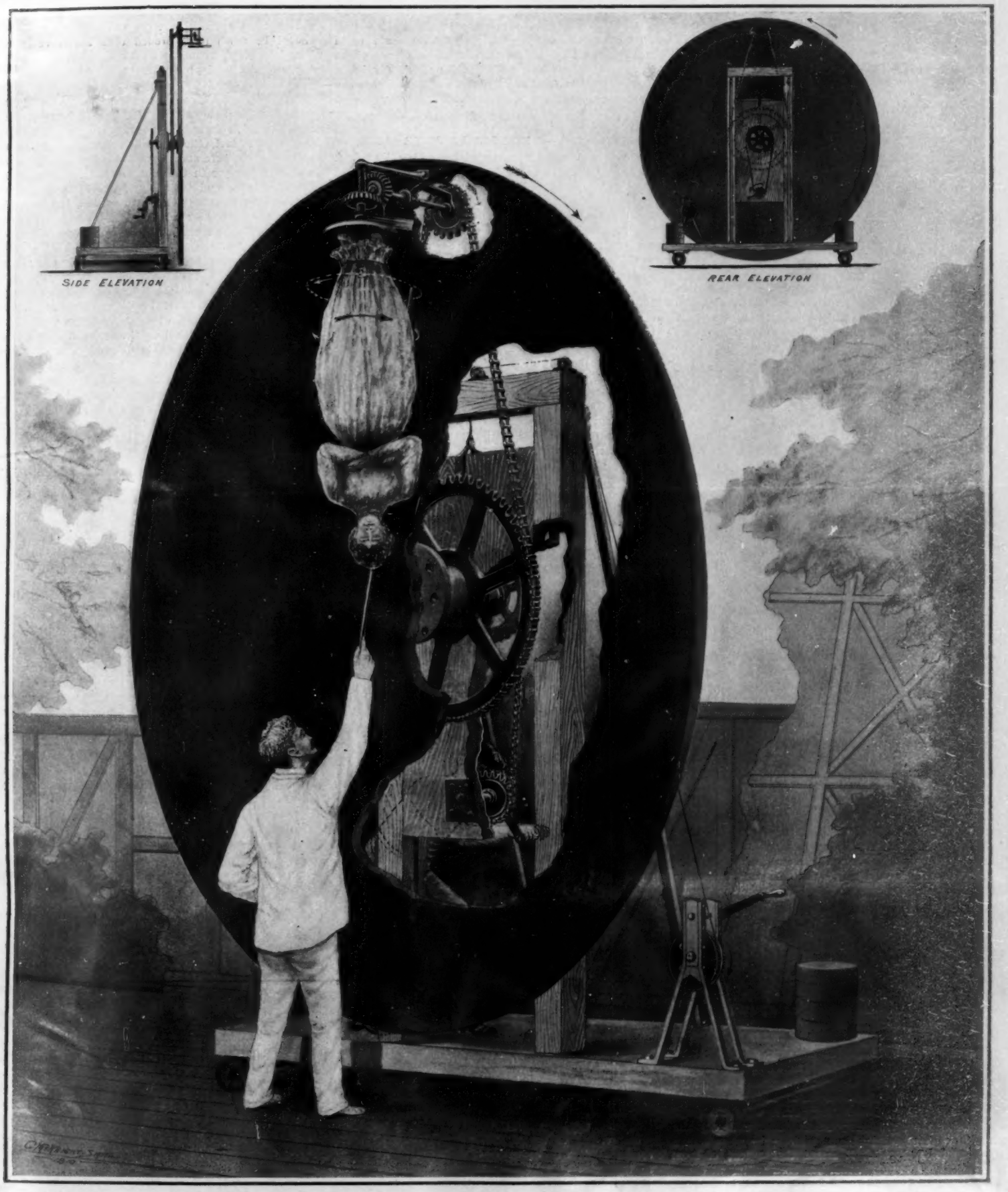

In this stage illusion the spectators see an apparently unsupported figure floating in the air, revolving and rotating with several motions at the same time.

A CURIOUS STAGE ILLUSION.—[See page 295.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, OCTOBER 15th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A WARNING TO THE AIRMAN.

THERE is a lesson and a warning contained in the tragic death of Chavez and the all-but-fatal accident which recently happened to Hamilton at Sacramento, to say nothing of the death of Rolls and other similar accidents, the exact cause of which has not been made public. The lesson is that in performing those spectacular evolutions which are the delight of the onlooker, and particularly the long dive in which the fall of the aviator is suddenly arrested a few feet above the ground, the airman is subjecting his machine to stresses which are much greater than those to which it is subjected during steady flight. It is probable that the factor of safety (to use a well-understood term) in the aeroplane is smaller than in any other instrument of transportation. The determination of the size and strength of the members is, even to-day, largely empirical, that is to say, it is largely a question of guesswork. The constructor, it is true, has now a few years of past experience to guide him; but the medium in which flight is being made is so elusive that it is difficult to determine with any close accuracy the extent of the dynamic stresses to which an aeroplane is exposed in traveling through the air. It is probable that the best-designed machines have a fair margin of safety under the ordinary conditions of straight-away flight in steady winds; but when the aeroplane in its flight enters a belt of swiftly eddying wind, where it is subjected to sudden puffs which may strike one or the other side of the machine independently, the dynamic stresses must increase rapidly and rise far beyond those which the machine endures under normal conditions.

Yet we believe that even these stresses are not to be compared with those which are set up in an aeroplane when the daring aviator is performing swift turns and suddenly arrested descents for the entertainment of the public. Particularly dangerous is the now common trick of descending at a steep angle on which gravity assists the motor in driving the machine to earth in a long, swift glide, and where the aviator, by a quick turn of his elevating plane, brings the machine suddenly to a level keel before alighting. Such an evolution is certainly spectacular, and the machine apparently sweeps from its diagonal to its horizontal flight without the slightest suggestion of heavy strain. Yet, as a matter of fact, at this very instant, the whole fabric, and especially the main supporting planes, are subjected to bending stresses tending to break the wings from the body, which must be far in excess of those which occur during normal flight.

Willard, one of the most daring and able of our younger airmen, has told us that at such times the strain is so great that the whole machine will "grunt" in protest, and the bamboo struts of the forward framework supporting the elevating planes will buckle out of shape under the heavy strain. And well may the machine grunt and buckle in protest; for when a dive is instantly arrested, it means that a load of from 600 to 1,000 pounds, which has been falling at a vertical rate of from 12 to 20 feet a second, is suddenly checked, and the whole work of absorbing the shock has been taken by the delicate framing and fabric of the wings. Poor Chavez, after coasting down from the altitude of a mile and a half, at which he had crossed the Alps, when he was but a few feet from the ground, started his powerful motor and simultaneously swung his machine into the horizontal, with the result that the impact of the broad wings upon the inert air was too great for their strength and one of them broke off, throwing him to his untimely death. Similar in character was the fearful accident to Hamilton, who is particularly fond of displaying his skill in the aerial dive.

There is a call for a very careful analysis of the stresses to which biplanes and monoplanes are subjected under all possible conditions. Strain sheets, similar to those which are drawn up in the designing of bridges, should be completed, in which the maximum stresses which may occur in every part of the machine are written down; and upon this strain sheet the sizes of the respective members should be determined. Such designing would not necessarily make any considerable increase in the total weight of the aeroplane. Surplus material in some parts of the machine would be transferred to others where it was needed. The result would undoubtedly be to eliminate many fatal accidents of the kind which has marred the progress of the sport during the present year.

GUN EROSION—A REPLY BY PROFESSOR ALGER.

WE recently reviewed an article by Lieut. Commander H. E. Yarnell, in which he advanced the theory that erosion is due to the escape of the powder gases past the projectile, through minute openings between the rotating bands and the bore of the gun, during the earlier travel of the projectile down the bore. It would seem that the Commander had made out a pretty strong case in favor of his theory; but we have now before us an article on gun erosion by Professor Philip R. Alger, U. S. N., in which he puts forward certain objections to Mr. Yarnell's theory which seem to him conclusive. Professor Alger believes that the necessary and sufficient conditions for gun erosion are the intense heating of a thin film of metal at the surface of the bore, and a rush of gases over that surface which carries away a certain amount of the heated metal. That the movement of the gases over the heated surface is a requisite of erosion, is shown by the fact that the rear part of the powder chamber is not worn away by repeated firing, nor is the inner surface of a closed bomb in which powder charges are burned for experimental purposes.

The objections advanced by Professor Alger against Mr. Yarnell's theory are as follows:

1. The forward slope of the powder chamber and the bore behind the rammed-home position of the projectile erode, the rate of wear of the bore just in rear of the rotating band being the same as that of the bottoms of the grooves at the beginning of the rifling. This wear cannot be accounted for by escape of gas past the projectile.

2. In the rammed-home position of the projectile, and until it has moved forward enough for its rotating band to be forced into the rifling, the grooves offer comparatively free passages for the escape of gas; moreover, there is at all times much closer contact between the copper band and the tops of the lands than there is between it and the bottoms of the grooves. Consequently the wear of the bore would be chiefly, if not wholly, confined to the grooves were it caused by escape of gas past the projectile. As a matter of fact the wear of the tops of the lands is about double that of the bottoms of the grooves.

3. The pressure of the gas, which is only about 2 tons per square inch when the projectile begins to move, increases rapidly, attains its maximum of 15 to 18 tons when the projectile has moved from 6 to 10 or 12 calibers along the bore, and then decreases slowly. The linear expansion of the bore abreast the rotating band also increases as the projectile moves forward, both on account of the increasing powder pressure and on account of the diminishing thickness of the gun wall, the maximum enlargement of bore probably occurring when the shell is about half way to the muzzle. Moreover, the driving edges of the rotating band wear away as the projectile moves. Consequently there should be a very much greater escape of gas past the shell after it has moved a few calibers than when it has merely moved enough to force its band into the grooves, and the greatest erosion, if it were caused by gas escape, would not occur at the beginning of the rifling, but farther down the bore.

4. The latest type guns have much greater muzzle velocities than earlier types, mainly because of their larger powder chambers that allow the use of larger charges of powder without much increase of maximum pressure. If the pressure curves of such guns are compared, it will be found that from the origin up to the point of maximum they do not differ much, the greater velocity given by the larger charge being mainly due to the more sustained pressure from the point of maximum to the muzzle. The conditions relating to the escape of gas past the projectile before it moves and during the early stages of its motion are, therefore, almost the same in high-power and in low-power guns of the same caliber using the same sort of powder with about the same maximum pressure. But there is an immense difference in the erosions of such guns; a 12-inch Mark II. gun that has been fired 500 rounds with velocities not exceeding 2,100 foot-seconds is only eroded to about the same extent as a 12-inch Mark V. gun after 50 rounds with 2,700 foot-seconds. This is clear proof that erosion depends upon the quantity of gas (number of heat units) behind the projectile as well as upon its quality (pressure and temperature); whereas the amount of gas that escapes past the projectile and its erosive effect can only depend upon pressure and temperature (the time of action being considered constant).

5. Experiments with gas escaping through vents having shown that copper is worn away more rapidly than gun-steel, the rotating band, past which all the gas that is supposed to erode the bore must escape, should be much more eroded than any part of the bore by a single round. As a matter of fact the rotating bands of fired projectiles show no signs at all of erosion.

In support of his contention, Professor Alger quotes from the English official "Treatise on Service Ordnance," which describes the effects of erosion as of two kinds; first, the smooth wearing away of the surface of the bore and its gradual enlargement by the action of the gas in the rear of the projectile, which is called *wear* and is independent of the sealing of the bore by the projectile; and second, the irregular eating away of the surface of the bore in holes and gutters, which is mainly due to windage and imperfect sealing of the bore.

And so, in the discussion of this highly interesting subject, we seem to have arrived about where we had started; for the weight of Professor Alger's clearly-stated arguments cannot be disputed. The time is now surely ripe for a discussion of the most extraordinary results which have lately been obtained at Sandy Hook in the tests to determine the value of certain erosion preventive devices of Mr. Brown, of the Brown wire gun. We understand, unofficially, that these tests have been so successful as to raise the question whether gun erosion is due to one or a conjunction of several contributory causes. A full report on the tests will be awaited with no little interest.

AN OBSERVATORY FOR SIMULTANEOUS COSMICAL AND TERRESTRIAL STUDIES.

THE recently founded Observatory of the Ebro, situated near Tortosa, Spain, is probably the unique example of a great institution devoted entirely to the study of the interrelations of solar and terrestrial phenomena. The Observatory belongs to the Jesuits, but has a quasi-official character, and has been aided by subventions from the national and provincial governments. Its director is Rev. Ricardo Cirera, who has recently been in America attending the solar conference on Mt. Wilson.

The observatory carries on continuous observations in solar physics, meteorology (especially atmospheric electricity), and geophysics (including the study of terrestrial magnetism, earth currents, and seismology). The solar observations include daily photographic measurements of the spots and spectroheliographic observations of the calcium flocculi. The work in atmospheric electricity includes observations of ionization, potential, and Hertzian waves (registered by the ceraunograph).

This fine institution is an embodiment of an idea that is every day gaining ground among progressive meteorologists; viz., that fluctuations in the activity of the sun find a more or less immediate response in many phenomena of the earth's atmosphere—in addition to the effects long since recognized upon the earth's magnetic field. In the investigation of the phenomena in question meteorologists and solar physicists meet upon common ground. The same idea found recognition a few years ago in the appointment of a solar commission by the International Meteorological Committee, and is further expressed in the large amount of attention now bestowed by meteorological observatories upon the measurement of solar radiation.

The Observatory of the Ebro has just published the first number of a monthly bulletin, in which all the cosmical, atmospheric, and telluric phenomena that are studied by the observatory are discussed in their inter-relations; the continuous measurements of the various elements in question being represented by a series of "graphs" arranged one above the other on the same plates.

Prof. Howard Crosby Butler of Princeton University has announced that statuary and gold ornaments of great archæological value have been unearthed in the heart of Asia Minor. One of the discoveries is a Lydian temple of great size and in a good state of preservation.

ENGINEERING.

Further particulars of the Japanese, home-built merchant marine show that whereas in 1890, Japan possessed but thirty steamships of 6,800 tons total, ten years later she possessed fifty-three home-built steamships, aggregating 15,300 tons. In 1909, the total had run up to 68 steamships, of a total tonnage of 50,800. The corresponding figures for Japanese-built sailing vessels are, in 1890, 13 ships totaling 1,200 tons; in 1900, 193 ships of a total of 17,900 tons, and in 1909, 198 sailing vessels whose total tonnage was 15,800.

The battleship "Nebraska" has won the competition for the twelvemonth, ending June 30th, for the best condition of machinery among battleships and cruisers. She has a percentage of 109.376, and, therefore, will receive the trophy, which is a bronze tablet measuring about three feet by one and a half feet. The last session of Congress appropriated money for encouraging engineers in keeping the machinery of the ships in the best possible condition. It is estimated that already the competition has saved the government one million dollars in coal and oil-fuel bills.

The two-track tunnel of the Michigan Central Railroad, which for several years has been under construction beneath the Detroit River, between Detroit and Windsor, Ontario, has been opened for service. It was considered desirable to familiarize the operating staff of the railroad with conditions before passenger service was inaugurated, and therefore the first trains run through were freight trains. This tunnel will take the place of the powerful railroad car ferries, which for so many years have been a prominent feature in transportation at this point.

On October 1st, Naval Constructor Richard M. Watt entered upon his duties at Washington, D. C., as Chief of the Bureau of Construction and Repair. Mr. Watt has long been known as one of the most able and energetic of the younger men of our corps of naval constructors. His distinguished predecessor, Read-Admiral Washington L. Capps, who has now served thirty years in the navy, according to a Washington dispatch, will probably be employed in general inspection of naval construction in the various private shipbuilding establishments, and in the yards where government work is in progress.

There was recently exhibited in the Engineering Society's building in this city a model of a section of construction wharf, which is capable of propelling itself above the surface of the water by means of movable "spuds" or legs. The walking wharf has been successfully used in Great Britain, notably at Peterhead, Scotland, where the wharf moved itself out over the bed of the harbor to an exposed position, where drilling operations were carried out from its deck, and 10,000 cubic yards of granite was successfully blasted at a depth of 24 feet below high water.

Referring to the recent article in the SCIENTIFIC AMERICAN describing the damage done to trees and shrubs in connection with the tarring of the driveway of the Bois de Boulogne in Paris, a correspondent informs us that the authorities in Sioux City have recently discontinued the use of tar on the park driveways because of the damage done to grass, shrubs, and trees adjoining the tarred surfaces. Another correspondent has recently drawn attention to the fact that injury of this character probably results from carelessness in the application of the hot tar, the fumes from which are destructive to vegetable life.

A most important use of concrete in engineering structures is the method which has been adopted for the strengthening of the old wrought-iron trestle approaches to the Danville, Illinois, railroad bridge, and the St. Charles bridge. These structures, which were built many years ago, were constructed of Phœnix columns, with diagonal tie rods. With the great increase that has come of late years in the weight of trains, it has become necessary either to strengthen these trestles or remove them altogether. The former course was followed; and the method adopted was to incase the columns in concrete. Tests of the strength of these reinforced compression members show that the addition of the concrete has raised their strength fully 50 per cent.

It now seems probable that the Steinway tunnel, extending beneath the East River from Long Island to 42nd Street, will be sold to the City of New York and become part of the municipally owned transportation lines. This tunnel, which was built a few years ago by the interests which are operating the present subway system, was offered to the city for $7,000,000; but the price was not found to be satisfactory. The present negotiations include a proposal to add a third track, to be used for express trains, on the existing Second, Third, and Ninth Avenue elevated lines. Although there is a prejudice against any extension of elevated roads in New York, the increase in travel is so great that the addition of these third tracks, at least temporarily, has become an emergency measure.

AERONAUTICS.

A German aviator named Haas was killed on October 1st while engaged in a distance competition. He descended at 5 o'clock in the afternoon of October 1st, after covering about twelve miles. For some unexplained cause, his machine dropped suddenly to earth.

Osnabruck is to have a monument to mark the spot where the "Zeppelin VII." came to grief. A huge block of stone is to support a bronze statue, and is to be embellished with a representation of the accident. Upon the block will appear in German the words: "Onward in spite of all. On this spot the airship 'Zeppelin VII.' was wrecked in a storm June 28th, 1910."

The work of preparing Belmont Park for the international aviation meeting is progressing rapidly. Several of the pylons have been erected on the main course, and two or three of the sheds will soon be ready for the machines. As fast as the sheds are completed, regularly-entered aviators who are ready will proceed to try out their machines on the grounds.

Two aviators named Dickson and Thomas collided while circling the aerodrome at Milan on October 1st, Dickson was taken out of the wreckage fatally injured. Thomas was injured about the legs, hands and head, but not so seriously. Dickson is an English army officer, and Thomas a French who had intended to take part in the international aviation meeting at Belmont Park.

Henri Wynmalen, a Hollander, only 21 years old, who received his license as an air pilot as late as last month, established on October 1st, a new world's record for altitude by rising to a height of 2,800 meters (9,186 feet) in a biplane. He has beaten the late George Chavez's mark of 7,892 feet. As in the case of Morane, Wynmalen's motor seems to have failed him when he reached his highest point. He made a perilous descent to earth in thirteen minutes. He stated that he suffered intensely from cold.

A new British flyer, the "Valkyrie I.," made a flight recently. This machine is the fifth of a series of experimental models with which trials have been carried out on Salisbury Plain during the past seventeen months. It is a monoplane, and is characterized by several interesting features, both in design and construction. There is no tail, and the pilot sits in front of the engine, which is in front of the main planes; he thus has a clear outlook in every direction. In front of the pilot is a leading plane, beneath which is the elevator.

Under the title "The Trade Winds of the Atlantic Ocean," the British Meteorological Office has just published a series of papers dealing especially with the results of a long series of anemographic records made at St. Helena, and with what are believed to be correlated meteorological conditions in other parts of the world. The importance of the subject is far-reaching, as the trade-winds are, in a sense, the "main arterial circulation" of the earth's atmosphere. Thus fluctuations in the southeast trades of the Atlantic have been found, apparently, to synchronize with fluctuations in the rainfall of the south of England.

Dr. Kurt Wegener, director of the German meteorological observatory in Samoa, is endeavoring to interest the aeronauts of his native country in a plan for exploring New Guinea by means of a free balloon. It is proposed to drift across the island, in the comparatively steady and regular winds of that region, successively from several points on the windward side, and to have boats await the explorers on the opposite side, in readiness to take the balloon and its occupants on board and to convey them around the island to a fresh starting-point. The late Lieut. Moedebeck was much interested in this project, and had hoped to take part in the expedition.

Leon Morane, who was to have been one of the contestants at the Belmont Park meeting, which will open on October 22nd, fell in his monoplane near Paris on October 5th, and sustained injuries which will probably confine him to a hospital for weeks to come. His left leg was broken in two places. In a 100 horsepower Blériot monoplane, accompanied by his brother Robert as a passenger, Morane was attempting to win the Michelin $20,000 prize, which is to go to the first aviator who flies from Paris and lands on the summit of the Puy de Dome, a feat which Weymann recently attempted and almost succeeded in accomplishing. The Puy de Dome is a mountain 4,800 feet high, near Clermont-Ferrand, and the distance to be covered is about 217 miles. Morane fell soon after leaving Paris. Just how the accident occurred it is difficult to ascertain from the newspaper dispatches. According to one account, Morane lost his way because of a fog, and was five miles off the route when his machine dropped from a height of 50 yards. It is stated in the same account that the accident was caused by the breaking of a wire controlling the warping mechanism, but that Blériot immediately hurried to the scene of the accident and discovered the cause to be a can of gasoline which had lodged between the tiller wires.

SCIENCE.

Ernst von Leyden, one of the world's greatest pathologists, died on October 5th at the age of 68. He was a successor of Traube's at the University of Strasburg. Later he went to Berlin.

A telegram has been received at Harvard College Observatory from Professor W. W. Campbell, of the Lick Observatory, stating that Brooks' periodic comet was observed by Aitken and Wilson, September 28th, 7249 G. M. T., in R. A. 19 h. 47 m. 51.1 s. and Dec.—28 deg. .08 m. 39 s., being visible in a large telescope.

In all atomizers for perfumes, etc., which are now in use the rubber bulb is detached from the bottle, with which it is connected by a tube of rubber or metal. In consequence of this arrangement, the apparatus is of ugly appearance and inconvenient bulk. In a new atomizer the bulb occupies a depression in the wall of the bottle, to which it is securely attached, although it can be easily removed and replaced by a new bulb, when it is worn out. The whole forms a smooth, round instrument, differing little in shape from an ordinary bottle, easily handled, and of graceful appearance. All of the parts: bottle, bulb, nozzle, and cleaning needle, are interchangeable and are sold separately.

The walls of dining-rooms are often adorned with plates of rare porcelain, which are commonly attached to the wall by means of strips of tin, the ends of which are bent over the edges of the plates and detract from the ornamental effect. A new plate hanger in which this defect is obviated has three strips of tin, terminated by neat little gilded hooks, which are the only parts of the device that are visible from in front. The strips of tin pass through three slits in a small plate of tin, behind the porcelain plate, and are bent over the edges of the slits to hold them securely in place. The same strips may be used for plates of different sizes by bending them at different points. The tin plate carries a ring which may be slipped over a hook attached to the wall.

This is the season of fresh mushrooms, and likewise, unfortunately, of many cases of mushroom poisoning, a fact which lends interest to a report recently made to the Académie des Sciences by the French scientists, MM. Radias and Sartory. Selecting two of the most dangerous varieties of mushrooms, the amanita phalloides and the amanita mappa for experiment, an extract of their toxic principle was made. Intra-peritoneal injections of this virus were then made, using rabbits for the experiments, in the manner usual when preparing antitoxin serums. At the end of four months the rabbits were found to be completely immunized, and could eat the most poisonous mushrooms without ill effect. This indicates that persons suffering from mushroom poisoning may be cured by a serum prepared in a manner similar to that of the diphtheria and rabies antitoxins.

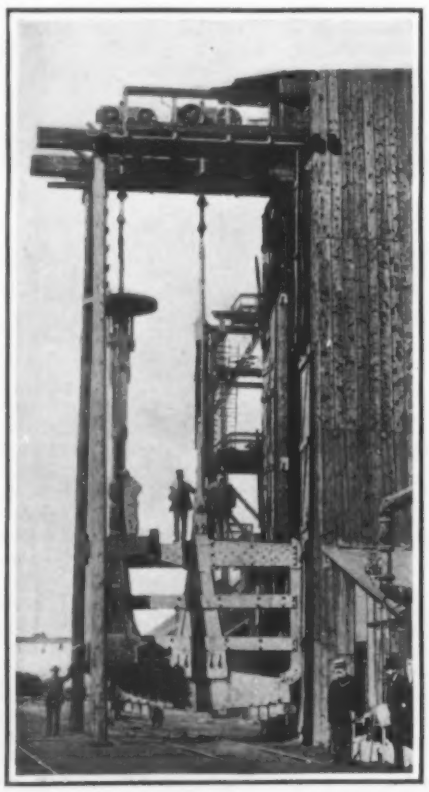
The Department of Education of the city of New York, through its Supervisor of Lectures, Dr. Henry M. Leipziger, will give a series of public lectures on physics and chemistry at St. Bartholomew's Lyceum Hall in New York city. The lecturers are all of them men well known in their particular fields. Dr. Charles E. Lucke of Columbia University will deliver a course of eight lectures on power. Mr. Stephen R. Morey will deliver three lectures on chemistry. Besides these, there will be other lectures at various schools, among which may be mentioned those on inorganic chemistry by William Estebrook, extending over eleven Mondays; the Metallurgy of Iron and Steel, by Prof. Bradley Stoughton, of Columbia University, extending over six Wednesdays; the Chemistry of Common Things, by Dr. Frederick E. Breithut, extending over eight Thursdays; and the lectures on Dyeing, by Prof. Charles E. Pellew, extending over three Thursdays.

A bulletin has been received from Prof. E. C. Pickering of Harvard College Observatory, announcing that a new star, whose approximate position is R. A. 17 hours 52 minutes 15 seconds, Dec.—27 degrees 32.3 minutes (1875), was discovered by Mrs. Fleming in the Constellation Sagittarius, on October 1st, 1910. It appears on sixteen photographs taken at Arequipa with the 8-inch Bache and 1-inch Cooke telescopes, between March 21st, 1910, and June 10th, 1910. The magnitude has been estimated as varying from 7.8 to 8.6 between these dates. The spectrum is quite faint, but shows the bright hydrogen lines $H\beta$, $H\gamma$, $H\delta$, $H\varepsilon$, $H\zeta$, and $H\eta$, with a trace of $H\gamma$ as dark on the edge of greater wave length of the bright line $H\gamma$. The star does not appear on seventeen photographs, taken between July 23rd, 1889, and October 7th, 1909, although most of them show stars fainter than the twelfth magnitude, and one plate shows stars of the fifteenth magnitude or fainter. An observation by Leon Campbell on October 3rd, 1910, with the 24-inch reflector of this observatory, confirms the presence of this object and gives its magnitude as about 10.5. Of the fifteen new stars known to have appeared during the last twenty-five years, eleven have been found at this observatory,—nine by Mrs. Fleming from the photographs of the Henry Draper memorial.

DEEP EXCAVATION BY BORING

BY J. F SPRINGER

In order to get down under the earth's surface, it is often necessary to do three things: excavate the material, resist the pressure of water and quicksand, and keep the walls of the shaft intact. At times, every one of these problems is an exceedingly severe one. The question of excavation presents no great difficulty, however, if workmen can be present at the point where the "spoil" (as it is called) is being removed. The pick, shovel, blasting apparatus and the like then suffice. The procedure of the pneumatic caisson solves all three problems in a very short, satisfactory manner—the water and sand are excluded by the air-pressure, the shaft walls are restrained by the caisson, and the concrete tube, and the workmen (called "sand hogs") operate at the bottom of the shaft. Here, down beneath the surface, the men work in an atmosphere which may have several times the normal tension. This immediate presence facilitates the excavation, but at the same time sets a limit upon the depth. It has been found that men can endure only about three atmospheres above normal. Now the air-pressure must be about equal to that of the water at the bottom. When a depth of about 100 feet below the water level is reached, the atmosphere in the working chamber has about reached the limit of human endurance. For such shallow excavation as this, the pneumatic caisson is, however, admirable, as has repeatedly been demonstrated in the foundation operations on the lower part of Manhattan Island. The sinking of the concrete foundation piers for the Singer Building was a prominent example. Another was the foundation work of the building of the Trust Company of America on Wall Street. The latter is an excellent instance of a fourth problem sometimes met. At times, the excavator must not only care for the shaft and the operation of putting it down, but also for the surrounding structures. Many buildings are founded not on rock, but upon soil underlaid by quicksand. Withdraw part of the quicksand and subsidence of the buildings may take place with disastrous results. So in lower Manhattan foundation operations, the engineer may find himself under the necessity of so removing material from the shaft that beds of quicksand underlying buildings should not be disturbed. The pneumatic method enables this to be done. But, as already pointed out, 100 feet below the water level is about the limit of its application. On the continent of Europe, where mining operations often call for shafts sunk through water-bearing strata to depths of 500, 1,000 and even 2,000 feet, the pneumatic caisson has but a limited application in mine operations. But the principal problems still remain. Often, indeed, the inflow of water can be dealt with by pumps and conditions are otherwise such that ancient hand methods can be employed. But sometimes the water cannot be controlled or the shaft sides cannot be maintained by ordinary means, and the engineer finds himself compelled to seek other procedures. Efforts—and some of them successful—have been made to go down by methods in which the soil was frozen and the excavation made by blasting the material thus hardened. At other times a cast-iron lining has been forced down either by its own weight or by that weight reinforced by jacks, assistance being rendered by excavation within. This latter method is known as the *drop shaft* procedure. The lining grows at the upper end. Another method is to suspend the lining from an encircling support. Excavation then proceeds to a point somewhat below the bottom of the lining, when a new section is put in. The lining, called *tubbing*, grows thus at the bottom. This procedure is in direct contrast to the drop shaft method, and is termed that of *underhanging*, or *suspended tubbing*. In one of the illustrations are shown sections of tubbing used for such operations. Still another system proceeds by means of boring.

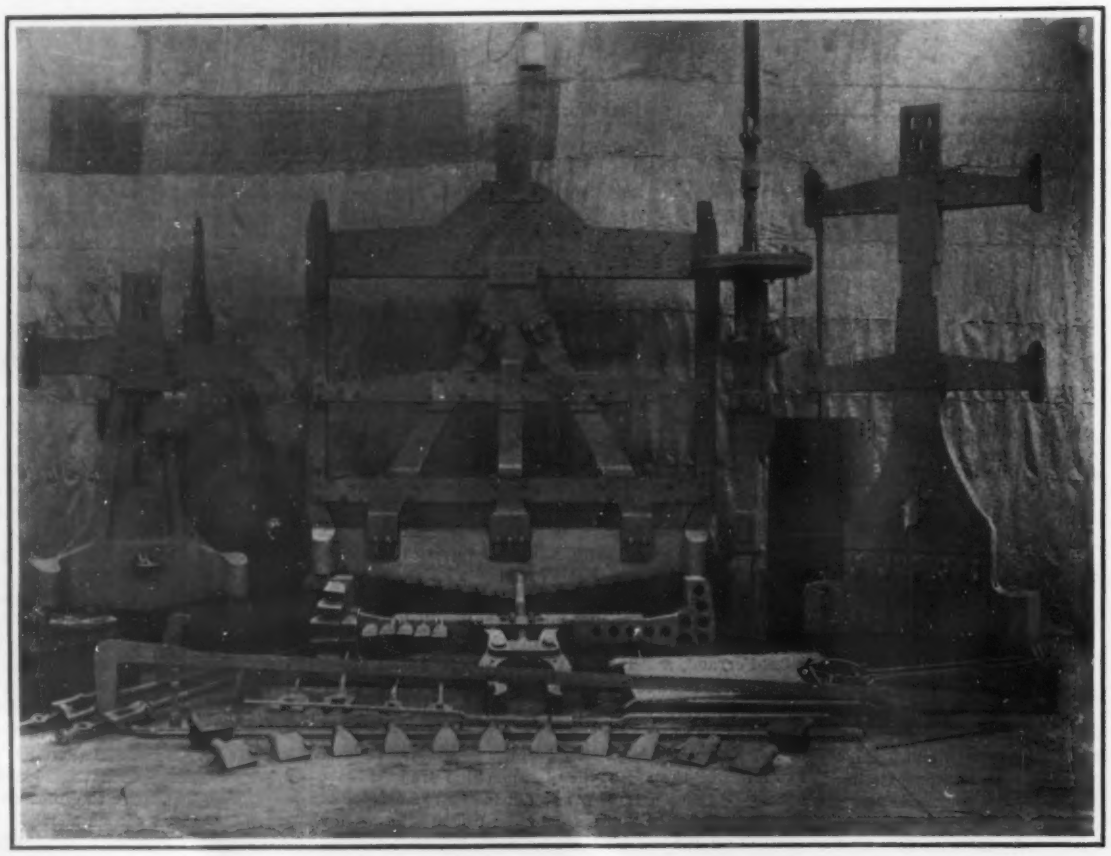


The pilot boring tool to the left is 6 feet and the main tool in center is 13 feet in diameter.

A 13-foot cast-iron ring for lining shafts from 1,000 to 2,000 feet in depth.

In the boring of artesian wells and other holes of small diameter, we are familiar with the drill weighing perhaps half a ton or more and having the general form of a cold chisel. By raising and dropping this heavy tool, turning it somewhat between times, the penetration is secured. This method is essentially the same as that adopted in some of the great boring operations in Europe. However, the matter is not quite so simple. Suppose that the full shaft diameter is 13 feet. Boring operations will be begun with a tool, a trepan, corresponding to, say, half this diameter. By means of this, a shaft will be sunk coaxial with the proposed final shaft. Even this tool will have a very considerable weight. Of course, it will have to be withdrawn every now and then to permit the removal of the *débris*. It will be understood that this procedure can be carried on whether water is present or not. Naturally when the shaft is more or less filled with water, the impact will be lessened. It would seem that 6 feet is

(*Continued on page 304.*)



With this massive tool shafts up to 13 feet in diameter have been bored.

SINKING LARGE-DIAMETER SHAFTS BY THE WELL-BORING PROCESS.

THE VANDERBILT CUP RACE SLAUGHTER

A GROTESQUE REFLECTION ON MODERN CIVILIZATION

There is a psychological side to such dare-devil contests as that which was run off over the country roads of Long Island for the Vanderbilt cup. Some

Fal car, winner of the Wheatley Hills contest.

of us have been asking whether the crowd which assembled to witness it would have been so large and tumultuous if it was known beforehand that the conditions of the race were so safe that the possibility of injuries and death had been entirely removed. It is a grotesque reflection upon our modern civilization that the danger of such exhibitions should constitute, for many people, half their charm. We are tempted to ask whether, after all, our much-vaunted civilization is not shallow veneer, which, if it be peeled off, would reveal below something of the same old brutality which led the multitudes of Rome to the Coliseum to witness its unspeakable cruelties.

It is the fact that most of the accidents were entirely preventable that makes the list of injuries and fatalities of this last race so shocking. If racing cars weighing about one ton apiece are to be allowed to rush over our country roads at speeds of from 60 to 75 miles an hour, it should be the very first care of those who are responsible for the race to see to it that the course is so patrolled that no spectator can approach closer than fifteen to twenty feet from the race course; and particularly should care be taken at the turns where the disablement of a car is certain to send it hurtling on a tangential course far from the roadbed.

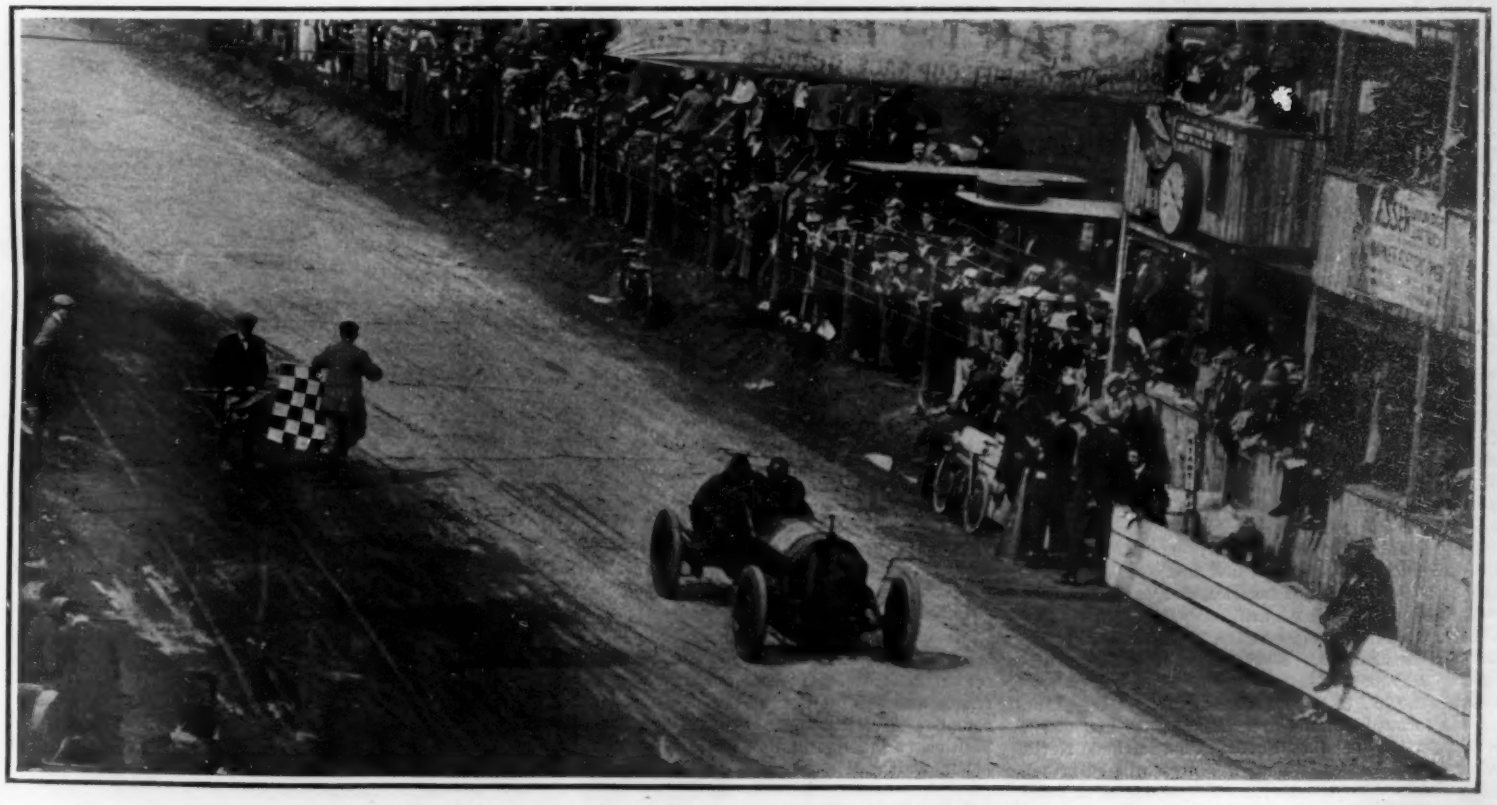
The crowding of the spectators on the course in this last race was particularly inexcusable over that part of it, approximately one-half, which lay over the Motor Parkway; for the whole of this section is provided with a lofty wire fence, set well back from the concrete driveway. Had the authorities provided a sufficient number of police, it would have been an easy matter to keep the crowd outside of this fence on the understanding that if they came within it they did so at the risk of arrest. Yet it is a fact that this portion of the course was just as badly crowded as were the country roads and the streets of the villages where no such fencing was provided.

The question of policing is mainly a question of expense; and in view of the large receipts from an event of this kind it should be entirely possible for the management to provide the 1,500 or 2,000 special officers, which would be necessary to cover the whole circuit, and keep the crowd of spectators everywhere under control.

In our issue of October 8th we gave an account of the race; it will be sufficient here to repeat the leading features. The circular course, which included the concreted Motor Parkway, measured 12.64 miles, and the contestants, by making the circuit 22 times, covered a total distance of 278.08 miles. It was good going on the Parkway, but rough on the country roads, which, owing to the long drought, had been considerably loosened up by the practice work of the contestants during the week preceding the race. Thirty-two cars were entered. The pace during the earlier part of the race was exceptionally fast, Chevrolet in a Marquette-Buick covering several miles at an average speed of nearly 75 miles an hour. The event was won by an Alco, which was driven by Grant at an even speed, which averaged 65.4 miles for the whole course. This establishes a new record, the best previous performance being made by Robertson, who won the cup in a Locomobile in 1908. The second car was a Marmon, driven by Joseph Dawson, and the third place was taken by a National car.

It is estimated that the race was witnessed by about a quarter of a million people.

The Marmon, about to pass the Simplex at Hicksville turn.



Grant in the Alco car winning the race. Average speed 65.4 miles per hour.

THE VANDERBILT CUP CONTEST FOR 1910.

THE SOLAR AND LUNAR ECLIPSES IN 1910

BY FREDERIC R. HONEY, TRINITY COLLEGE

The year 1910 exhibits a series of four eclipses—two of the Sun and two of the Moon, differing in certain particulars according to the laws governing these phenomena.

A total eclipse of the Sun, May 8th. A total eclipse of the Moon, May 23rd. A partial eclipse of the Sun, November 1st. A total eclipse of the Moon, November 16th.

As the solar eclipse of May was total only in the inaccessible regions of the Southern hemisphere, and the partial eclipse in November will be visible mainly from the Pacific Ocean north of the Equator, it is only as celestial phenomena that they are of interest to the student of astronomy.

If the orbits of the Earth and Moon are correctly plotted, and their positions shown at the date of a solar eclipse, the position of the Moon relative to the plane of the Ecliptic may be determined by an inspection of the plot; and the hemisphere upon which the Moon's shadow is projected becomes obvious.

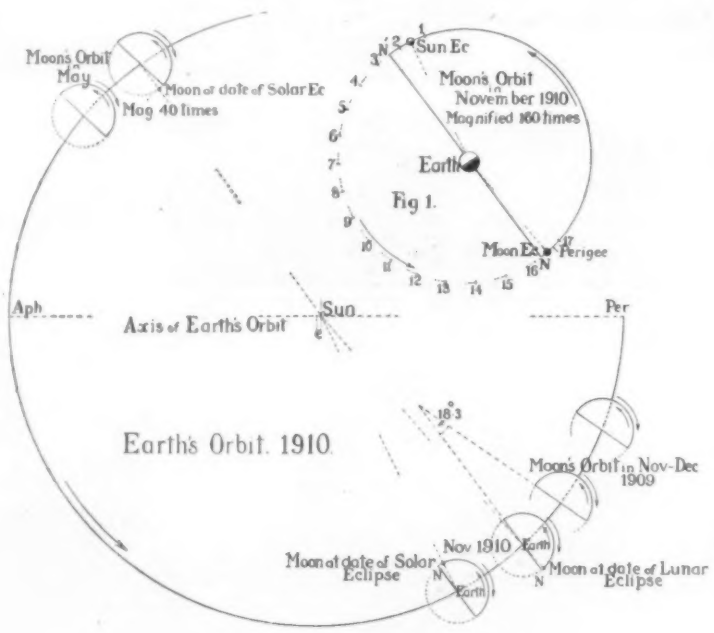
The advance in the dates of eclipses, due to the retrogression of the line of nodes, is clearly illustrated by comparing its position in 1909 and 1910. The angle between these lines is 18 degrees 3 minutes. In the plot the arrow without the Moon's orbit shows the direction of this rotation; and that within the orbit shows the direction of the Moon's revolution around the Earth. An eclipse is possible only when the Moon is at or near one of the nodes. In a solar eclipse, if it is too far from the node, the Moon's shadow falls beyond the Earth's surface. In a lunar eclipse, if it is too far from the node, the Moon does not come within the Earth's shadow.

In order that the position of the Moon relative to the Ecliptic at the date of each eclipse may be clearly seen, its orbit is magnified forty times in the plot of the Earth's orbit; and again one hundred and sixty times in Fig. 1, which shows the position of our satellite for each day between the eclipses in November. That part of the orbit which is represented by a full line is above the plane of the Ecliptic; the remaining part below that plane. N and N' are respectively the ascending and descending nodes. At the date of the solar eclipse in May the plot shows that the Moon was below the Ecliptic and approaching the ascending node. The Moon's shadow was therefore projected on the Earth's southern hemisphere. On November 1.55d., the date of the next Solar eclipse, the Moon will be above the plane of the Ecliptic; and the shadow will therefore be projected on the northern hemisphere. The Moon will be near apogee, and will reach the descending node between Greenwich noon November 2nd and 3rd. At the date of the lunar eclipse (November 16.52d.) the Moon will be very near the ascending node, and about midway between that point and perigee. The eclipse will be visible at Washington; the beginning visible generally in Africa, Europe, Central and Western Asia, South America, and Eastern North America; the ending visible generally in Africa, Europe, Western Asia, North and South America.

A series of eclipses recurs at the regular interval of 6,585 1/3 days. This period is eighteen years and 11 1/3 days when four leap years are included. When there are five leap years in the period the number of additional days is 10 1/3. But the century year (1900) was not a leap year. The only leap years included in the period here considered were 1896, 1904, and 1908. As a consequence the interval is eighteen years and twelve and one-third days. A Solar eclipse occurred on April 26.38d., 1892. The corresponding one was that of May 8.71d., 1910. At each date the Moon's shadow was below the Ecliptic and was projected on the Southern hemisphere. But at the latter date the area of visibility was farther west. During the additional fraction of a day the Earth had rotated from West to East. The first eclipse was visible from a very small part of South America, and was principally seen from the Southern Pacific, the area of visibility including New Zealand. At the latter date this area included Australia and New Guinea. A similar comparison may be made between the Solar eclipses of October 20.23d., 1892, and of November 1.55d., 1910. At the former date the area of visibility included a large portion of the North Atlantic and North America; at the latter date this area will be principally confined to the Northern Pacific and a small portion of Northeastern Asia, including Japan.

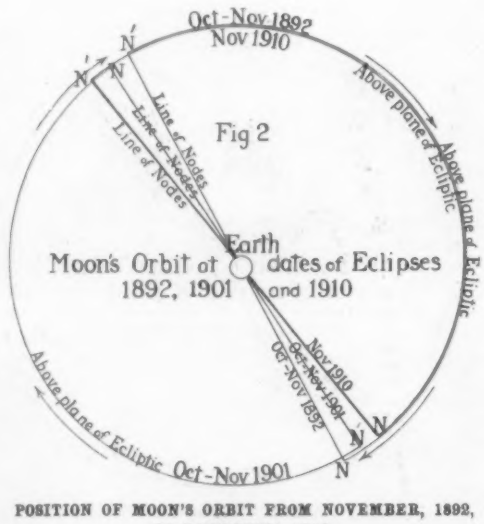
It is interesting to note the repetition of eclipses extending over longer periods, i. e., periods which are multiples of 6,585 1/3 days. The Solar eclipse of November 1.55d., 1910, belongs to the following series. Solar eclipses occurred on September 28.41d., 1856; October 9.71d., 1874; and October 20.23d., 1892. The number of leap years in the cycles were respectively 4, 5, and 3.

Fig. 2 illustrates the rotation of the Moon's orbit during the period from November, 1892, to November, 1910. In order to avoid confusion only that part of the



POSITIONS OF THE MOON DURING ECLIPSES OF 1910.

orbit which is above the Ecliptic is shown. It is represented in three positions—at the beginning, the middle, and the end of the period. In each position the scale of the orbit is slightly changed in order that the plots may be clearly distinguished; and they are limited by the line of nodes. The heavy line shows its position in November, 1910. Between November, 1892, and November, 1901, the orbit made nearly one-half of a rotation; and the ascending and descending nodes nearly exchanged places. Between November, 1901, and November, 1910, the orbit makes nearly one-half of a rotation; and the nodes now occupy the position shown in the plot But the rotation of the



POSITION OF MOON'S ORBIT FROM NOVEMBER, 1892, TO NOVEMBER, 1910.

orbit is not quite completed. This period is 18.6 years; while the period of the eclipse cycle is 18.03 years.

It should be noted that the form of the Moon's orbit is continually changing; and that the plots in this respect must be regarded as approximate. The eccentricity and the position of the perigee change. The actual form of the orbit, however, does not affect the position of the line of nodes or the longitude of the Moon, which determine the dates of the eclipses.

It is reported that M. Labro has constructed for the French army a new dirigible of the semi-rigid type, capable of traveling at a high speed, and of covering the distance from Paris to Marseilles in eleven hours. It is stated its design is such that there is absolute security in the event of a rupture of the envelope, even though it may be torn in several places. The dirigible, the cost of which is stated to be 220,000 francs, has been built under circumstances of the greatest secrecy. It has a cubic capacity of 5,000 millimeters, and can carry eight passengers. It will be named "La Fregate," and will take part in the forthcoming maneuvers. Scrupulous precautions have been taken as regards the handling of the airship at the practice ground. Owing to its construction, it is easy when it comes to earth to excavate two trenches in which the two cars can rest, the stem and the stern at the same time being moored in line with the direction of the wind.

Preparing Metallic Radium.

According to a memoir presented to the French Academy of Sciences, Mme. P. Curie and M. E. Debierne have succeeded in preparing metallic radium, the much-discussed element which had so far been known only in the form of its salts.

The two experimenters availed themselves of the method suggested by Gunz for the production of metallic barium, which method consists of preparing the amalgam and afterward expelling the mercury by distillation under suitable conditions.

After some preliminary experiments on barium (with only about 0.1 gramme of material), Mme. Curie and M. Debierne proceeded to prepare the amalgam of radium by the electrolysis of a perfectly pure solution of radium chloride, using a mercury cathode and a platinum-iridium anode. The total amount of radium chloride experimented upon was 0.106 gramme, while the amount of mercury used was about 10 grammes. After electrolysis the solution was found still to contain 0.0085 gramme of salt. The amalgam was found to decompose water and to be extremely inconstant in contact with air, being perfectly liquid, in opposition to barium amalgam, which under identical conditions contains numerous crystals. After being dried, the amalgam was rapidly introduced into an iron vessel, previously reduced in pure hydrogen. After placing this vessel into a quartz tube, the whole apparatus was evacuated.

The distillation of mercury is an extremely delicate operation which should be so conducted as to avoid even a moment's boiling, lest some particles of the substance be projected. The experimenters carried out distillation in an atmosphere of pure hydrogen, keeping the pressure of that gas permanently above the pressure of saturated mercury vapor at the temperature of the iron vessel as determined by the aid of a thermo-electric couple.

In view of the very minute quantities of material at the disposal of the two experimenters, care had to be taken to warrant an absolute purity of the hydrogen. As hydrogen purified and dried according to the ordinary process is still acted upon by the amalgam and metal, the gas, before entering the apparatus, was made to pass through a platinum tube heated in the electric furnace.

After distilling the larger part of the mercury at 270 deg. C. the temperature and gas pressure in the interior of the apparatus were gradually increased. In order to be able to watch the contents of the iron vessels throughout the duration of the operation, the experimenters used gas burners for heating the apparatus. While being solid at about 400 deg. C., the amalgam would melt with rising temperatures, giving off mercury. The boiling temperature, which could be determined most exactly, at the same time increased gradually, reaching a limit of 700 deg. C., at which temperature no distillation of mercury nor condensation on the cold walls of the vessel took place. However, the metal at the same time began to give out abundant vapors which would attack energetically the quartz tube. At this stage of the operation the experiment had to be discontinued.

The iron vessels were then found to contain a brilliantly white metal, which at about 700 deg. C. would begin to melt suddenly and which in the experimenters' opinion, is practically pure radium. The metal would adhere strongly to the iron, being separated therefrom with some difficulty.

Metallic radium is altered very rapidly at the contact with air, being blackened instantaneously, in consequence, it seems, of a nitrogen compound being

formed. Some metal particles having been scratched off with a small metal tool, one of them, on being dropped on white paper, was found to produce a dark spot as by combustion. On coming into contact with water, these metal particles instantaneously decomposed the latter most energetically, dissolving the greater part of it, which would seem to show the solubility of the oxide. A blackish residue, which doubtless is the nitrogen compound produced by the reaction of the metal and air, would be dissolved nearly completely after adding a very small quantity of hydrochloric acid. Having been dissolved practically completely in the diluted acid, the metal could not contain any appreciable amount of mercury.

The iron vessel containing the remainder of the metal was then introduced into a tube which was sealed in the vacuum. This is to serve in measuring the penetrating radiation of the metal and ascertaining whether its radio-active properties really correspond to theoretical calculations.

Though the radio-active equilibrium has not yet been reached, the first tests would seem to show the increase of activity to occur in accordance with the law of the production of emanation, the limit of radio-activity of the metal being about normal.

As metallic radium is much more volatile than barium, the two experimenters expect to purify it by sublimation in the vacuum on a cooled metal plate.

A CURIOUS STAGE ILLUSION.

The stage illusion which constitutes the subject of the front page illustration of this week's SCIENTIFIC AMERICAN was invented several years ago by Mr. Robert B. Smith, an Australian inventor, now a resident of New York.

Thanks to an ingenious mechanism, it gives the effect of a figure which not only hovers in the air apparently unsupported, but of a figure which has simultaneously three motions—one revolving motion in a vertical plane, another a rotary motion around the longitudinal axis of the figure itself, and a third, which will be apparent from the following description of the mechanism itself.

The illusion consists of a wheeled truck on which two posts are carried, tied together at the top by a cross piece, the whole constituting a kind of guillotine frame. Between these two posts a block slides vertically like the knife of a guillotine. Through the sliding block a horizontal shaft runs which carries a large wooden disk about 12 feet in diameter, covered with black velvet, a large sprocket wheel, and a small sprocket pinion. The sliding block can be raised and lowered by means of a steel cable attached to its top, and passing over two pulleys on the cross piece connecting the two posts, and then down to a windlass on the truck, as shown in the rear elevation on the front page. The large sprocket wheel is connected by a chain with a small sprocket pinion carried on a short steel shaft passing through the wooden disk near its periphery. The short shaft is provided with a bevel gear which meshes with a second bevel gear mounted on a short shaft parallel with the large wooden disk, and supporting a small circular platform upon which the performer is supported. The small sprocket pinion on the inner end of the driving shaft which carries the large wooden disk is connected by a chain with a small sprocket pinion secured to the bottom of the sliding block and operated by a crank. By turning the crank it is evident that the performer who is supported on the platform is rotated on her longitudinal axis, and that the large wooden disk is revolved, so that she is given two motions at the same time. By operating the windlass which raises and lowers the sliding block, which is done by another man, she is given a third motion, the entire wooden disk being raised and lowered as the sliding block rises and falls.

The performer, preferably a woman, must wear a special steel harness under her costume, the harness being supported by two straps passing over her shoulders and two around her thighs. Her waist is surrounded by an iron hinged belt fixed to the harness. To the back of the belt a steel rod is attached. On the end of the rod, which is bent to fit the performer's figure at the back, is a metal journal, which journal is riveted to the rod. The rod passes only half way through the jonrnal, so as to permit the shaft running parallel with the black wooden disk to enter. By means of a thumb screw the rod running from the belt is secured to the bevel gear shaft running through the circular platform upon which the performer stands.

The truck is pushed out upon the stage, previously draped in black, so that the performer seems to float across the stage. In order to heighten the effect of the illusion, the stage manager may pass a wand completely around the performer, as shown in our front page illustration, so as to make it appear that she is not at all attached to any object.

Under the name of "Ione," this illusion has puzzled many music hall habitués. It completely deceived the late Mr. Charles Bertram, who was considered in his day one of the best English magicians. It was impossible from the auditorium to discover that there is a fixed wheel in the mechanism, for the entire stage is draped in black and the large disk on which the performer is carried is covered with black velvet, as well as the platform on which she stands. A black shield hides the bevel gearing.

The Current Supplement.

The recent French military maneuvers have unquestionably demonstrated the efficacy of the aeroplane as a weapon of war. The Paris correspondent of the SCIENTIFIC AMERICAN was present at the maneuvers, and in the current SUPPLEMENT, No. 1815, gives an able account of what the aeroplane accomplished.—The third instalment of Mr. Edward H. Guilford's article on the construction of a thousand-mile wireless receiving station is continued.—Gradually the Holy Land is being covered with a network of railways, and the screech of the locomotive may to-day be heard not only in Jerusalem, but on the shores of Galilee, in Nazareth, and in many other places associated with Biblical history. Mr. Harold J. Shepstone presents an excellent account of these Holy Land railways, accompanied by some interesting photographs.—Fine old pieces of furniture are prized by collectors largely because age has given a new beauty to the wood. There are many artificial methods of giving to wood this artistic appearance. The methods by which this can be done are described very ably by H. Wislicenus.—In an article entitled "Experiments in Animal Psychology," Mr. B. Forbin scientifically disposes of many of the absurd fables that are still accepted, such as the scorpion who stings himself to death, the instinctive desire to kill mice supposed to be possessed by cats, and the like.—Mr. O. Ivan Lee contributes an interesting paper on a possible extension of the periodic law, in which he presents a consideration of the Lothar Meyer curve for 1909.—The second instalment of Prof. Millikan's paper on the isolation of an ion is presented.—Mr. S. S. Hough recently delivered before the Royal Society of South Africa his presidential address on the aims and methods of astronomical research. An abstract of his paper is published.

Official Meteorological Summary, New York, N. Y., September, 1910.

Atmospheric pressure: Highest, 30.31; lowest, 29.79; mean, 30.08. Temperature: Highest, 90; date, 6th; lowest, 54; date, 20th; mean of warmest day, 80; date, 6th; coolest day, 62; date, 19th; mean of maximum for the month, 75.1; mean of minimum, 61.7; absolute mean, 68.4; normal, 66.5; average daily excess compared with mean of 40 years, 1.9. Warmest mean temperature of September, 72, in 1881; coldest mean, 61, in 1871. Absolute maximum and minimum of September for 40 years, 100 and 40. Average daily excess since January 1st, 2.5. Precipitation, 1.43; greatest in 24 hours, 1.17; date, 1st. Average for September for 40 years, 3.59. Accumulated deficiency since January 1st, 8.41. Greatest precipitation, 14.51, in 1882; least, 0.15, in 1884. Wind: Prevailing direction, northwest; total movement, 5,953 miles; average hourly velocity, 8.3 miles; maximum velocity, 35 miles an hour. Weather: Clear days, 10; partly cloudy, 13; cloudy, 7; on which 0.1 or more of precipitation occurred, 5. Relative humidity, mean of 8 A. M. and 8 P. M., 72.9. Thunderstorm, 6th. Dense fog, 5th and 6th.

Sardine Bait.

French sardine fishers use, as bait, the roes and other waste products of the Norwegian cod fisheries. This bait is expensive and its price is continually rising, owing to the increasing demand. An artificial bait, which is much cheaper, has recently been employed, but with only partial success, as it sinks too quickly and often lures the sardines downward, instead of drawing them up into the nets. Attempts are now being made to remedy this defect. The success of these attempts would bring joy to the fishermen, but not to the dealers in Norwegian bait who enjoy a very lucrative monopoly. The question is one of burning interest and has nearly led to open war between fishermen and bait dealers on the French coasts.—Cosmos.

Return of the Brooks Periodic Comet.

BY WILLIAM R. BROOKS.

The Brooks periodic comet was observed at its return on September 30th with the large telescope of the Lick Observatory in the constellation Sagittarius in right ascension 19 h. 47 m. 51 s.; declination south 28 deg. 8 m. 39 s. This very interesting comet was discovered by Dr. William R. Brooks at the Smith Observatory, Geneva, N. Y., on July 6th, 1889; and computation soon showed that it was moving in an elliptical orbit, with a period of revolution around the sun of seven years.

It was observed at its succeeding returns in 1896 and 1903, and now has again swept into view, true to its predicted time. It is now only visible in large telescopes.

Another interesting fact concerning this comet is that it was found to be attended by four companions moving along through space with it. Although this has been noted in connection with some of the large comets, notably the great comet of 1882, it is quite unique among telescopic comets, and it is sometimes called the Brooks multiple comet.

Correspondence.

THE LATEST ARGENTINE, AMERICAN AND BRITISH BATTLESHIPS.

To the Editor of the SCIENTIFIC AMERICAN:

In an article in a recent issue of your paper you give a very interesting comparison between the U. S. S. "Wyoming" and Argentine ships now building. In speed the Argentine ship is the better, both in smooth and rough water, and the ship that has the greater speed, all things being nearly equal, is in the better position, for she can compel the other ship to fight on her terms. In radius of action the Argentine ship is also superior. These two would, in many cases, decide the combat, especially if both ships put to sea about the same time. In gun power the two designs are nearly on a par, the Argentine ship having the advantage, owing to her having the speed; for instance, she could take a range that would make the 6-inch gun effective on her opponent when the 5-inch gun would not be nearly so on defensive armor. While it is thinner in places in the Argentine ship, her commanding officer could, if skilful, offset that by again using his superior speed, for he could maneuver so that his opponent's shot would strike his thinner armor obliquely, and so make it of equal resisting power. The Argentine vessel being the larger and heavier, would keep her speed in a seaway better and would be a steadier gun platform. The freeboard and height of guns are so near alike that there is no real advantage in favor of the "Wyoming." The one turret which is higher on the "Wyoming" would have no material advantage over the other ship in a heavy sea, at all events, as the Argentine ship would be steadier. Moreover, the higher the gun the wider arc it describes as the vessel rolls. Finally, some of the guns at all events are father apart on the Argentine ship, and that also is an advantage. I think there is no doubt that naturally the designer, with larger dimensions and 3,000 tons more displacement at his disposal, can produce the better ship; and in summing up everything, you can't put a quart of power in a pint of displacement, designers being equal.

Now, as regards these ships being the most powerful, excepting the one being built for the Brazilian government by the Armstrongs, you will please excuse me if I take exception to that remark. There were launched a few weeks ago, and also a week or two later, two ships for the British navy, one of which is as powerful as either of these two designs, and the other more powerful than either of them. I refer to the "Lion" and the "Orion." The "Lion" is known as a battleship cruiser. She is 700 feet long, the longest warship in existence; displaces 26,000 tons, and is designed to steam 30 knots; carries armor 9 inches thick and eight 13.5-inch guns, all on the center or axial line of the ship. Here is a ship so much faster than either design that she can easily outmaneuver them and do it so that her 9-inch armor would be practically equal to their heavier armor. In gun power she carries guns of far greater range and penetration; also the eight guns practically fire the same weight of metal in a discharge as the twelve on your two designs. Her radius of action is greater than the "Wyoming," and fully equal to the Argentine ship; so that taking all things into consideration, although displacing about the same as the "Wyoming" and less than the Argentine ship, she could fully hold her own with either. With the "Orion" we have a vessel 584 feet long, 87 feet beam, and displacing on normal displacement 22,500 tons; speed designed, 21 knots, and likely to do as well as the "Vanguard," which was designed for 21 knots and made a maximum of 22½ knots. It will be seen that the "Orion" is an easier vessel to drive through the water, she being longer and narrower than the "Wyoming." In speed she is slightly better than the "Wyoming" and not quite so good as the Argentine vessel. In radius of action she is slightly better than the "Wyoming," and perhaps not quite so much as the Argentine ship. In gun power she easily beats both, as it is reported on good authority she will carry ten 13.5-inch guns, all on the axial line of the ship. In defensive armor she is the equal of either one. Here then is a vessel of less tonnage and more powerful than either one, provided it is true that she is to carry a 13.5-inch gun. The gun in question is 45 calibers long, weighs 86 tons, throws a projectile of 1,250 pounds with a muzzle velocity of 2,850 foot seconds, and is the most powerful piece of ordnance in existence on any ship or in any country.

Halifax, N. S. W. R. SHUTE.

A HUNTSMEN'S SCHOOL FOR TARGET PRACTICE

A FRENCH SYSTEM FOR IMPROVING MARKSMANSHIP

A huntsman, like a poet, is born, not made. His peculiar gift is innate, a heritage from his primitive ancestors. Skill in hunting can never be acquired by a person not born with the hunting instinct, but even a born huntsman does not attain the full development of his powers without training, in which the vague instinct of the primitive man adjusts itself to the employment of modern scientific weapons. Haphazard practice in the hunting field is not sufficient to produce the best results. A started hare or a flushed partridge is a mark too difficult for an excited novice, though he may have acquired great skill in aiming at a fixed target, in less distracting conditions.

The only rational and certain method of becoming a good shot in the hunting field is based upon systematic practice with moving targets, which gradually increase in difficulty until they present approximately the conditions actually encountered in the field. It is evident that the organization of such a system of training is not an easy matter. According to La Nature, the French gunsmith Mousseaux has solved the problem in a very ingenious manner, by devising an apparatus which gives a great variety of movements, closely imitating the natural motions of living creatures, to silhouettes of game animals and birds. A sort of sub-caliber practice is employed, the shotgun being converted temporarily into a rifle by the addition of a rifled tube (an earlier invention of M. Mousseaux) which enables the accuracy of fire to be correctly estimated.

M. Mousseaux has established a huntsmen's school, in which the pupils practise shooting at cardboard hares, snipe, partridges and other game, which run, leap and fly in a very lifelike manner. Problems of steadily increasing difficulty are successively presented and solved, and the pupil soon becomes competent to cope with the conditions of actual hunting. The apparatus by which the silhouettes are moved is of very simple construction and can be installed in any yard or court of moderate dimensions. The cardboard figure is mounted on a long rod *B* (Fig. 1) along which it can be drawn by winding up the cord *b* on the reel *F*. The cord is kept taut by a weight and the motion is reversed by unwinding the reel. The rod is attached to the grooved iron wheel *A*, and coincides with a diameter. The wheel is rotated on its axis, in either direction, by moving the lever *E*, the ends of which are attached to the ends of the cord $c\ c^1$, which passes over the grooved wheel and the two guide wheels *C C*. Finally, the inclination of the plane of the wheel *A* can be varied by turning the handle *M*. These three movements can be executed singly or in any combination. If the reel *F* is operated alone, the cardboard figure moves in a straight line along the rod. If the lever *E* is moved alone, the figure describes a circle of greater or smaller radius in the plane of the grooved wheel, which may be horizontal, vertical or inclined at any angle. By combining these two movements the figure can be caused to describe an infinite variety of curves in the plane of the wheel, and by simultaneously altering the inclination of that plane, and varying the rapidity and direction of the three independent movements, any curve in space can be described. The pupil begins with simple vertical movements, which are followed successively by inclined rectilinear movements and by curved flights of gradually increasing complexity. If he does not become a good shot after a properly graded course of these exercises he will never develop into a successful huntsman.

Fig. 1.—The Mousseaux moving target in two positions.

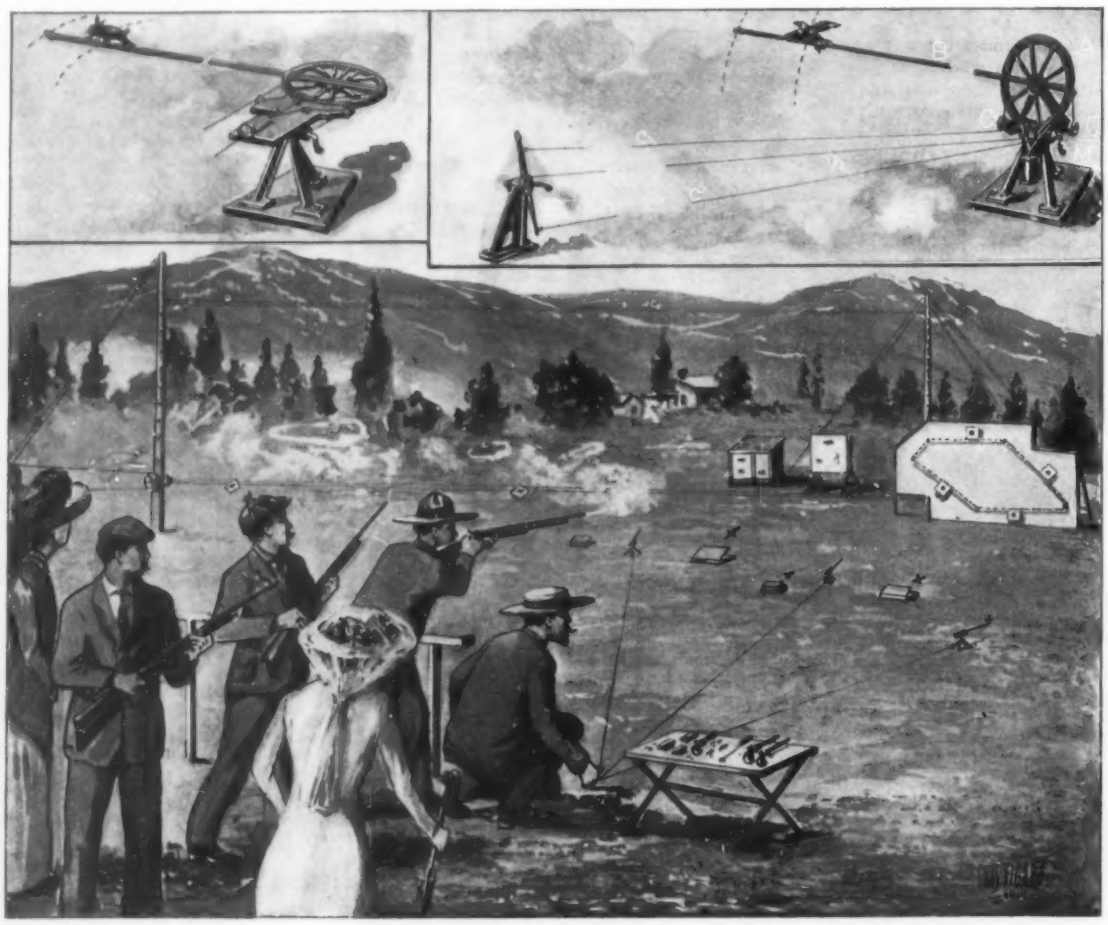


Fig. 2.—The Mousseaux school for huntsmen at Le Mans, France.

What is White Oak?

One of the most pertinent questions that has come before consumers and manufacturers of commercial oak timber is the question: "What is white oak?" and it will not only surprise those who handle oak wood to a great extent, but will also surprise most people who know something about oak, to be told that the so-called white oak timber of our markets is often a mixture not only of various species of the white oak group, but also of other species, such as the red oak.

That this is a generally unknown fact is evidenced by reports of the Forest Service of the Department of Agriculture, which, as a part of its work, is frequently called upon to pass judgment upon the identity of market woods in dispute.

For several years now, in fact, since the advent of automobiles, in which the use of oak enters very largely, especially for the spokes of wheels, the immense inroads made upon the apparently inexhaustible white oak forests by builders and manufacturers of wooden ware, have gradually so reduced the supply that the use of other species became inevitable.

All the oaks are divided into two groups by the foresters—the white oak group and the black oak group. One way of distinguishing between the two groups in the growing trees is by the fact that the black oaks require two years to mature their acorns, while the white oaks take but one. The woods of the two groups are also structurally different. The true white oak is merely one of the species which make up the white oak group, while red oak, on the other hand, belongs to the black oak group. The red oak is also known by other common names, among them mountain oak, black oak, and Spanish oak.

The marketing of the black oak group as white oak is hardly fair to the consumer, but there is so much confusion in the ordinary use of names of the oaks that it is almost impossible to keep them straight without resorting to the scientific names.

Red oak, for instance, is now much more abundant than white oak, grows faster, and is generally regarded as inferior, while white oak combines the utmost strength and toughness of any of the timber oaks, excepting possibly the southern live oak, which in colonial days was so highly prized for ship-building that it was protected by special laws.

It is almost impossible at the present time to obtain a consignment of white oak that does not contain a great many pieces of some other species. In addition to what true white oak may be used, there may be included in the shipment bur oak, chestnut oak, chinquapin oak, post oak, swamp white oak, cow oak and overcup oak, as belonging to the white oak group, while Texas red oak, red oak, and spotted or water oak make up the black oak group.

Real white oak timber of the first class quality is very largely cut into quarter-sawed boards, while a combination of one or more white oaks and red oak may constitute other cuts of so-called "white oak." In some markets, what is known as "cabinet white oak" is now understood to include a mixture of white oak and red oak, while it often signifies red oak only.

Owing to the immense amount of timber that has been cut from our forests in the past, and because the failure to plant new trees, has so reduced the supply of certain hard woods, the Department of Agriculture has gathered, through the efforts of its forest rangers and foresters, some ten tons of tree seed, which it is planned to plant in the burned sections of the West and in those sections where certain trees will thrive the best.

When one considers that in one pound of seed there are about ten thousand individual seeds, it will be realized how much time and labor were expended to secure ten tons. Out of these ten thousand individual seeds in each pound it is expected that there will mature about four hundred plants or young trees. The seed is to be planted where it is desired to have the trees grow, doing away with transplanting and thinning out.

In this manner the Department of Agriculture expects to be able to replenish the now nearly depleted forests, and at the same time to bring about relief from a possible wood famine.

The president of the Canadian Northern Railway recently stated that tenders are now being invited for the construction of fifty miles of track eastward from New Westminster, and it is hoped that this section will be completed this year. This will carry the line through the Chilliwack farming district to Hope. Construction is also to be started at once from Edmonton westward, a contract for seventy miles, to the McLeod River, having been let. From the Yellowhead Pass the line will follow the Thompson and North Thompson rivers to Kamloops, then follow the south bank of the Fraser to New Westminster. Asked when he expected to have the Canadian Northern Railway completed as a transcontinental line, Mr. Mackenzie replied that July 1st, 1914, had been fixed as the date of opening a through line from Montreal to the Pacific Ocean.

MAGIC FOR AMATEURS—XIV

MISCELLANEOUS TRICKS

BY W. H. RADCLIFFE

NO. 32. PLANT RAISING FROM SEED IN FIVE MINUTES.

Chief among out-of-door tricks adapted to the amateur magician is the plant-growing trick—a favorite one with East Indian fakirs. Select a place where the ground is solid, and bury about five inches below the surface a water bucket or pail *a a*, Fig. 49, open end upward. Upon a circular wooden float *c*, about three-fourths the diameter of the bucket and one inch thick, erect a rose bush or other plant *m*, about fifteen inches high, supporting it in a mound of earth as shown at *n*. Place this plant structure in the bucket, and carefully bridge over with earth the top of the hole, as shown at *s s*, so as to leave no trace of the opening above ground. For the performer's guidance, a pebble should be placed directly over the center of the hole.

When ready to do the trick, drop a seed on the ground over the center of the hole. Spread a piece of burlap or other loosely woven cloth *r*, about eighteen inches square, over the seed, and pat the seed under the cloth with the finger tips of the left hand, as in Fig. 49, thereby gradually working open the roof of earth over the hole. At the same time use the

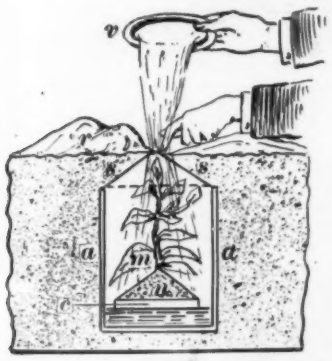


Fig. 49.—THE EARTHEN COVER IS BROKEN AWAY BY TAPPING WITH THE FINGER AND WATER ENTERS THE BUCKET.

right hand to pour water from a watering pot or can *v* upon the center of the cloth, and repeat some unintelligible words to mystify the spectators.

The water passing through the cloth will gradually fill the bucket, and by causing the wooden float to rise will force the plant up against the cloth, as in Fig. 50, until finally, when the bucket is full and the cloth removed, the plant will be seen as in Fig. 51, blossoming forth in the midst of a mud puddle. Even a hothouse grower's reputation will fade away beside such a performance as this, for from seed to flowering plant in less than five minutes is certainly rapid growth.

NO. 33. THE WIZARD'S BEVERAGE.

The transformation of paper shavings into steaming hot coffee and ice-cold milk is a pleasing one to both old and young.

Prepare for the trick by cutting up a number of newspapers into small bits or shavings sufficient to nearly fill a box about twelve inches long, eight inches wide, and eight inches deep. Having provided the paper and box, take two baking-powder cans about two

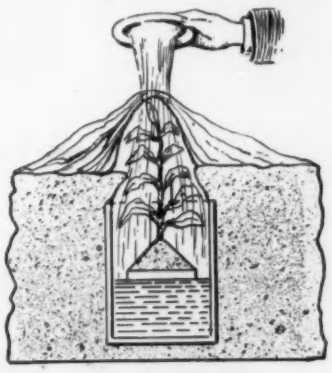


Fig. 50.—AS THE WATER ENTERS THE BUCKET THE PLANT IS FORCED UPWARD, CARRYING THE CLOTH WITH IT.

and one-half inches in diameter, and two covers from cans of the next smaller size, so that when the edges of the covers are bent out, as at *c* and *s*, Fig. 52, the covers will be supported in an inverted position upon the cans as indicated, *m* representing one of the cans and *v* one of the covers. Two other baking-powder cans resembling those just prepared as nearly as possible in size and appearance and two small napkins must also be provided.

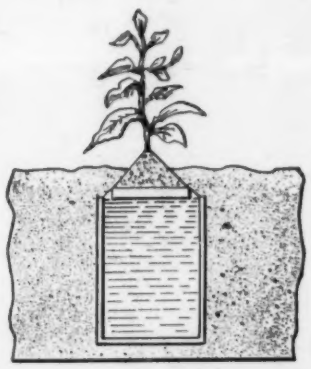


Fig. 51.—A FULL-GROWN PLANT APPEARS WHERE THE SEED WAS PLANTED.

Just before introducing the trick, fill one of the cans, supplied with an inverted cover, about three-quarters full of hot coffee, and its mate three-quarters full of cold milk. Place their covers on and fill the trays formed by them in the tops of the cans with some of the paper shavings previously made. Then bury the cans thus prepared in one end of the box among the cut papers. Place the other two cans on top of the papers in the box, and bring the entire outfit forward to be exhibited, placing the box upon a table.

Let the spectators examine the two empty cans; then holding up to view a handful of the paper shavings, explain that the box is filled with them. Receiving back from the audience one of the empty cans, insert its open end downward into the box, making a movement as if to scoop up with it enough paper to fill it. Instead, when it is in a horizontal position beneath the papers, allow it to remain there, and passing the hand along inside the box, quickly grasp the prepared can in line with it, containing the coffee. Bring this can up out of the box (its tray being filled with papers makes it appear as the can just introduced) and place it upon the table.

Next take the other empty can, and use the same method of procedure to produce the can of milk. Then exhibit one of the napkins, showing both sides of it, and spread it over one of the cans. Cover the other can with the remaining napkin. Returning again to the first can, make mysterious passes with the hand or wand over it, and then raise the napkin. In raising the napkin, place the partially opened right hand down over the top of the can; close it around the top and

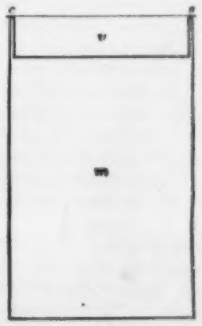


Fig. 52.—THE BEVERAGE IS BREWED IN BAKING POWDER CANS, EACH OF WHICH IS FITTED WITH AN INVERTED COVER AS SHOWN HERE.

then bring the hand up, grasping within it the napkin and concealed cover containing the papers. Carelessly toss the napkin and its contents into the box of papers, and at the same time take up in the left hand the uncovered can, showing to the amazed spectators the steaming hot coffee within it.

Remove the napkin and cover from the other can and dispose of them in the same way. Assuring the spectators that the milk is equal to that mother used to make, offer it to them either with or without the coffee, which latter should be strong enough to speak for itself.

Panspermy and Life Germs.

Recent experiments of M. Paul Becquerel seem to prove that life germs could not have been brought to the earth, for instance, from an outside point in the universe. The theory that such germs could travel across the interplanetary space has been upheld by numerous scientists such as Helmholtz, Van Tieghem, Lord Kelvin and others, and was recently affirmed by Arrhenius. According to the last, microscopic germs from the atmosphere of planets were carried off under the pressure of luminous radiations into the interstellar space and floated there for ages until they encountered other worlds which could thus receive life germs. In this attractive theory one of the most important factors in life preservation is neglected, this being the effect of ultra-violet rays emitted by burning stars. We know already that rays from quartz mercury lamps will destroy bacteria and humid spores in a few seconds at some inches distance. Will this be the same when dry and *in vacuo* at low temperatures? M. Becquerel wished to verify this point and used the different kinds of spores and bacteria which were specially hard to kill by the rays. Contained in vacuum tubes, they were plunged in liquid air and placed near the lamp. Most of the spores were destroyed in the first series of experiments. Special precautions were then taken to obtain the best possible state of dryness. The last spores, such as the Aspergillus, which had held out before, were finally destroyed after six hours exposure to the ultra-violet rays *in vacuo* and at the temperature of liquid air. Even though drying and extreme cold are favorable for the germs and allow them to keep their life in a suspended state, as previous researches showed, they are not invulnerable, so that the destroying action of the rays may be said to be quite universal. Seeing that the germs would no doubt be destroyed when in the inter-planetary space which is rich in ultra-violet rays, the above-mentioned theory as to the origin of life on the earth's surface seems to be seriously shaken.

The Cost of Motor Cars.

One of the most interesting tabulations in connection with the automobile industry has been made public by the Association of Licensed Automobile Manufacturers. It is a careful compilation of figures recorded with the A. L. A. M. for each year since 1903, and gives the average price of automobiles for each year since that time.

The chart shows an increase in the price of motor cars from 1903 until 1907, but since that time the average price has gradually declined. This is not the result of any radical reduction in the price of motor cars, but is brought about by the great increase in the manufacture and sale of machines selling at $1,500 or less. In the early days a car at less than $2,000 was rare, while now the greatest volume of business and the greatest number of machines are under that figure.

The sales recorded by makers licensed under the Selden patent are for American gasoline automobiles only. By comparison, however, the sales of steam and electric vehicles are small.

The figures show that the trend in manufacturing has been to each year give more for the same list price than to make any great cut in the selling figure. There has been a tremendous increase in the making of what are termed the moderate-priced cars, and a normal and healthy increase in the number of the higher-priced machines produced.

From $1,133.37 as the average price for cars in 1903, the average ran up to $2,137.56 in 1907, since which time it has decreased until the first six months of 1910 shows $1,545.93 as the average retail list price of cars.

The following comparative table indicates the average price for each year for the sale of gasoline automobiles licensed under the Selden patent (which is probably 85 per cent of the industry), including the first six months of 1910:

1903	$1,133.37	1907	$2,137.56
1904	1,351.45	1908	1,926.94
1905	1,609.79	1909	1,719.93
1906	1,853.93	1910	1,545.93

To Polish Ivory.—Smooth it with sandpaper, rub down defective spots, then rub off with soft flannel and washed chalk. The chalk can be moistened with water or oil. Finally, complete the polish with a piece of soft linen, on which a little oil has been dropped.

APPARATUS EXHIBITED AT THE EXPOSITI

BY JACQ

The exposition arranged this year in Paris by the French Society of Physics was, like its predecessors, an event of great interest to lovers of scientific novelties. The congress began with visits to the gas works at Landy and Gennevilliers, which have been recently equipped with improved furnaces with automatically charged and discharged horizontal retorts and also with the compartment ovens known as Munich ovens. On the following days Prof. J. H. Poynting, of the University of Birmingham, gave an account of some experiments on the pressure exerted by light, and Dr. W. Nernst delivered a lecture on the development of thermo-dynamics; but the principal attraction of the exposition resided naturally in the new apparatus exhibited by inventors and instrument makers. We shall not here describe all of these instruments, especially as some of them have been or will be described in other articles published in the SCIENTIFIC AMERICAN. Among the latter are the oscillograph of Blondel, Billon-Daguerre's apparatus for sterilizing with ultra-violet rays, the double-needle instruments devised by Ferrié and Carpentier for the measurement of electrical resistance, frequency and wave-length, the Brenot registering analyzer for furnace gases, the simplified physical apparatus designed by Chassagny, and others.

We will first consider Fabre's radio-activimeter, which can be used outside of special laboratories and, in particular, for the measurement of the radio-activity of mineral water at the spring. The instrument consists of a manometer and of an aluminium foil electroscope which is hermetically closed and serves as an ionizing chamber. The gas is introduced directly by aspiration into a vacuum through the large drying tube containing a layer of phosphoric anhydride which is visible in the photograph between the feet of the instrument. The vacuum is produced by means of a small hand pump connected to the central tubulure by a rubber tube. The water to be examined is contained in a bottle, the cork of which is traversed by a hollow needle, or very fine tube, through which the gaseous exhalations can enter the large drying tube and the electroscope. The displacement of the leaves of the electroscope is observed by means of a lens.

A vacuum having been produced, air is admitted and allowed to bubble through the liquid by means of a second hollow needle. These operations are repeated until the dissolved gases have been extracted from the water and to such an extent that the index of the manometer indicates the re-establishment of atmospheric pressure in the ionizing chamber. The electroscope then contains the greater part of the gas extracted from the liquid and, as the vessel is hermetically closed and perfectly dry, the measurement of radio-activity can be effected very rapidly.

The radioscope devised by Szilard possesses qualities which have never before been combined in a single instrument of this class. Sensitive, accurate, easily used and transported, it facilitates measurements of the radio-activity of soils, ores, mineral waters, deposits of hot springs, the atmosphere, etc., at any place. The principle of the apparatus is similar to that of other radioscopes and consists of the discharge of an electrified body by means of the conductivity acquired by the air in consequence of radiations from radio-active bodies. It has been proved that electric conductivity in gases is due to the presence of ions or electrified particles. The rays which develop this conductivity produce in the gas positive and negative ions which, moving under the influence of electrical forces, deposit their charges on electrified bodies. The electric current resulting from this moving of the ions has hitherto been measured by means of a gold-leaf electroscope or a quadrant electrometer, by measuring the velocity with which the gold leaf or the electrometer needle is displaced. In the former case the electric field is usually produced between a conductor bearing the gold leaf and a metal plate carrying the active substance and in metallic communication with the case of the instrument. The movement of the gold leaf is observed by a microscope with a micrometer eye-piece, by which the time occupied by the gold leaf in moving over any number of divisions of the scale can be determined. When the electrometer is used it is usually combined with a condenser formed of two plates. The radio-active substance is placed on one of these plates, which is insulated and charged to a high potential, and the other plate is connected with one pair of quadrants of the electrometer. The needle of the electrometer is also charged to a high potential and the velocity with which the spot of light reflected by its mirror moves over a divided scale is observed.

There is a third method, based upon the electric phenomena produced in quartz by pressure; but this method, like those described above, requires the use

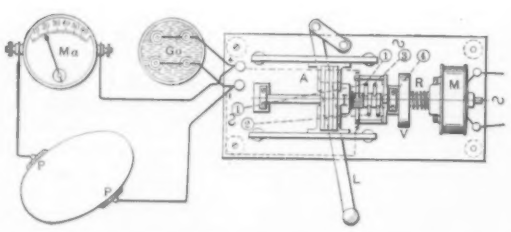
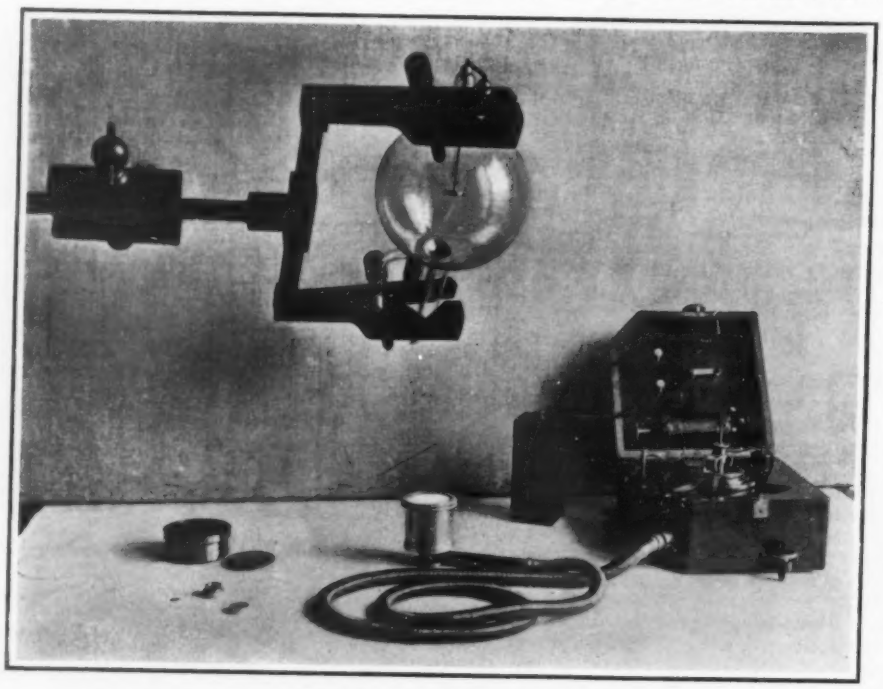
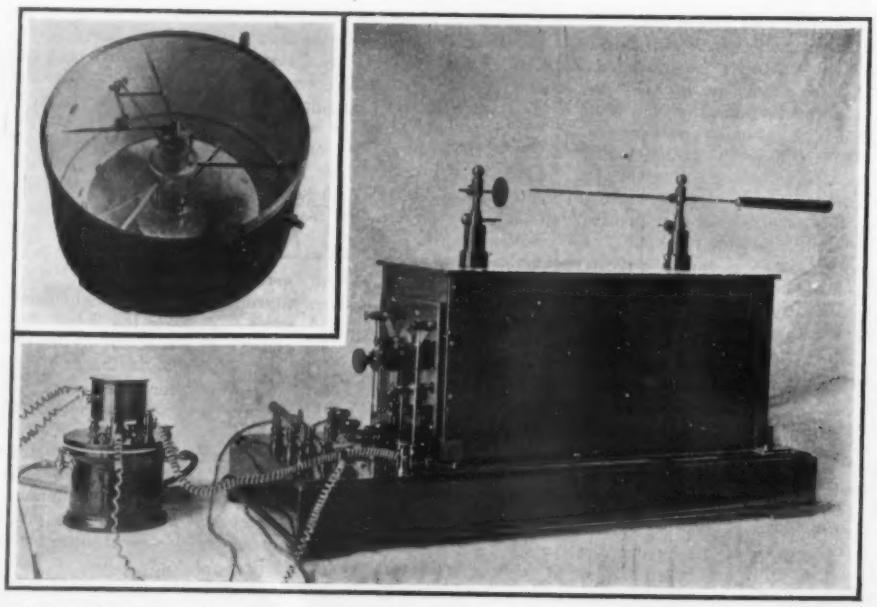


Diagram of Durand's electromagnetic apparatus with variable field.

Ancel's selenium cells in connection with the universal resistance box of Chauvin and Arnoux.



Szilard's radioscope.



Dunoyer's dygograph.—Ancel's universal induction coil with mercury and gas interrupter.

Bellini-Tosi radio
wirele

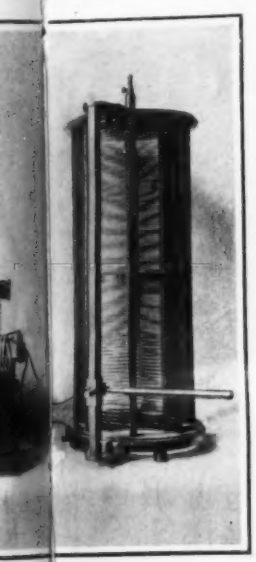
Apparatus for p
(currents f

Fabre's

ION OF THE FRENCH SOCIETY OF PHYSICS

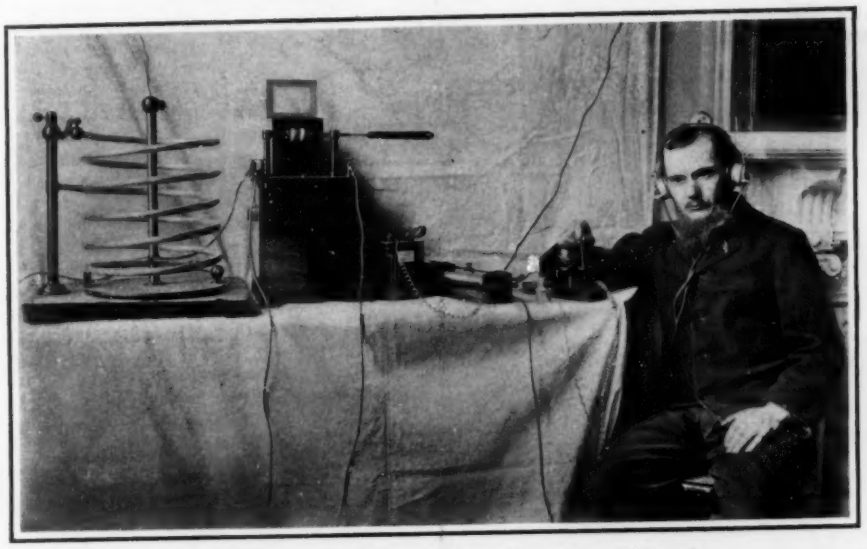
QUES BOYER

radio-goniometer for directed wireless telegraphy.



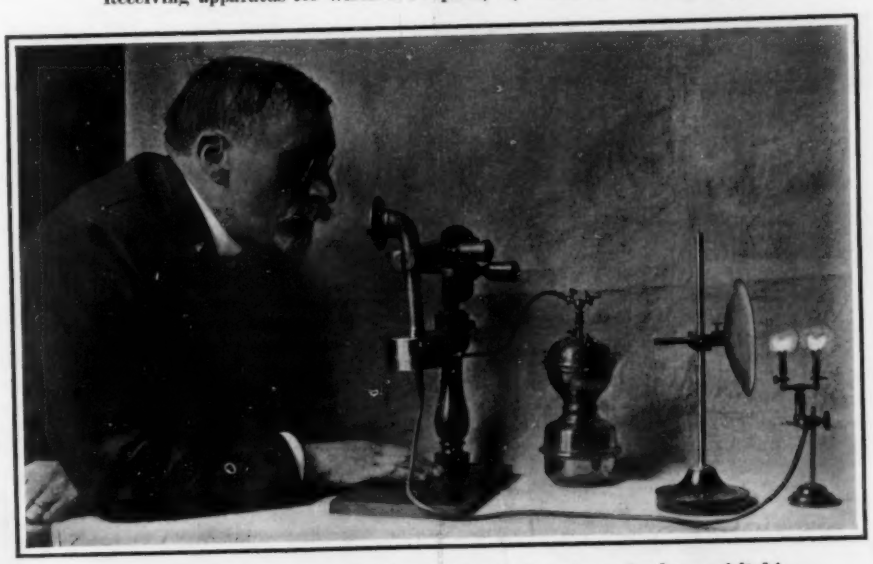
for producing high-frequency currents for medical use.

Fabre's activimeter.

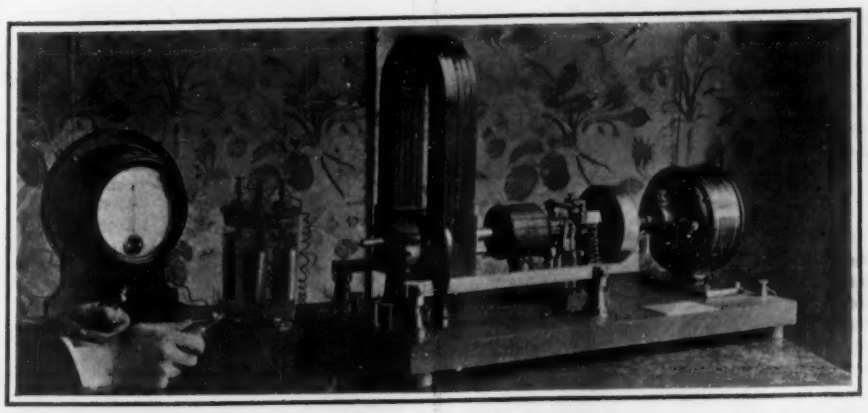


Transmitting and receiving apparatus for wireless telegraphy.

Receiving apparatus for wireless telephony by means of a beam of light.



Transmitting apparatus for wireless telephony by means of a beam of light.



Dr. Durand's variable field electric generator.

of apparatus which is costly and difficult to transport. Szilard's radioscope, on the contrary, is especially suitable for use on journeys, as, when folded for transportation, it forms a cylinder about four inches in diameter and three inches high. In this instrument the indicator of electric charge is of an unusual type. It consists of a rigid pointer which moves over a fixed scale and turns on a pivot placed in the axis of the cylindrical metal vessel shown in the photograph. This vessel is traversed in its middle part by a thin strip of highly insulating material, carrying at its middle a sharp point on which the light, magnetized needle turns. The needle is surrounded by a thin strip of metal with which it is electrically connected, so that the whole forms a perfectly insulated system. The cylindrical vessel is covered by a sheet of glass on which a divided scale is engraved. Errors of parallax are eliminated by reading the instrument by means of a lens, placed above the glass top and in the axis of the needle. In order that the position of the needle can be easily seen, no matter what the color of the substance under examination, one-half of the needle is white and the other black. For determining the radio-activity of liquids and gases the lower part of the cylindrical vessel is removed and replaced by condensers of special type. By other modifications, easily effected, the instrument can be transformed into an apparatus for the measurement of Roentgen rays or ultra-violet rays.

Wireless telegraphy and telephony were largely represented at the exposition. The Bellini-Tosi radio-goniometer is a wireless receiver of the type which has recently been installed at the new government station at Boulogne-sur-Mer. With this apparatus, which gave excellent results in the recent trials, it is possible to determine within one or two degrees the direction of a wireless station from which signals are received. By means of measurements repeated at definite intervals the geographical position of a coast station or of a ship at sea can be determined. It is also possible with this instrument to obtain the bearings of the ship on which it is installed in any condition of the atmosphere, a result which cannot be obtained in any other way. The type of instrument devised for this special purpose is called a Hertzian azimuth compass. Very successful results have been obtained with this compass on the ship "La Louisiane."

Another photograph shows an apparatus by which the resistance of selenium cells, in light and in darkness, can be conveniently measured. A Chauvin and Arnoux universal resistance box is employed, in combination with an accumulator. The same apparatus, arranged in a different way, can be used to measure the strength of the current which a given electromotive force produces in the selenium cell when illuminated by various sources of light, and consequently to determine the sensitiveness of the cell.

Louis Ancel exhibited some very simple apparatus for demonstrating the principle of wireless telephony, in schools. At the transmitting station the vibrations of the operator's voice are concentrated by a horn upon the membrane of a manometric capsule, through which a stream of acetylene flows to a burner placed at the focus of a parabolic mirror. The variations in the pressure of the gas which are caused by the sound waves produce corresponding variations in the flame and in the intensity of the beam of parallel rays reflected from the mirror. At the receiving station, a few yards away, this beam of light falls upon a second parabolic mirror, at the focus of which is placed a selenium cell, which is connected with an accumulator and a telephone. The variations in the intensity of the light produce corresponding variations in the resistance of the selenium cell and in the current which flows through the telephone. Hence the telephone reproduces exactly the words uttered at the transmitting station. The principal novelty of this apparatus is in the construction of the selenium cell, in which the thickness of the layer of selenium which separates the two conductors is reduced from about one millimeter (1/25 inch), the thickness usually employed, to a few hundredths of a millimeter. This modification greatly increases the conductivity and the sensitiveness of the cell.

The same constructor exhibited a universal induction coil which produces 10-inch sparks and possesses several interesting features. The secondary circuit is made in several sections, which are separated by multiple insulating partitions and imbedded in a very stable, solid insulator. The direction of the secondary current can be reversed, by means of a commutator, while the coil is in action. The coil can be operated by an attached interrupter with platinized contacts or by a detached interrupter of any type. Ancel's rotary interrupter, shown in the photograph of the coil, consists

(*Continued on page 305.*)

SAFETY DEVICES FOR WINDOWS.

BY JOHN A. HEINZE.

Two safety devices for windows are pictured herewith, which while home-made have all the advantages of the commercial article.

The device shown in Fig. 1 may be used where it is

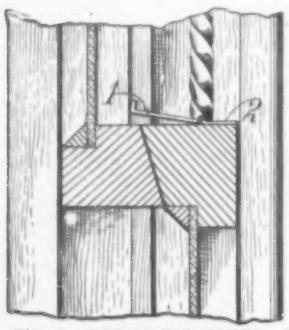


Fig. 1.—DEVICE FOR TEMPORARILY LOCKING A WINDOW OPEN OR SHUT.

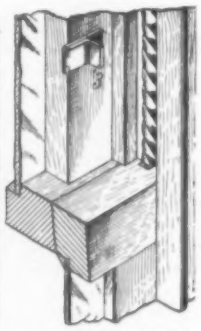


Fig. 2.—CATCH TO PREVENT OPENING A WINDOW BEYOND PREDETERMINED AMOUNT.

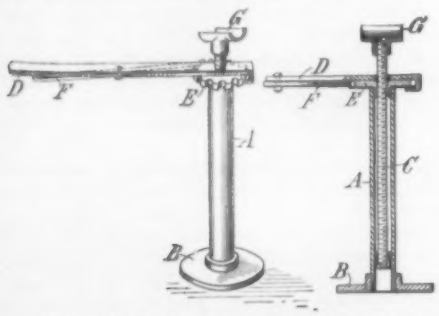
desired to keep both windows closed or both or either of the windows open. Under any of these conditions, with the catch in place as shown, neither window can be raised or lowered from the position desired. When not in use the leaf 1 may be thrown out of engagement with the upper sash, and the windows raised or lowered at will. It is made from a narrow hinge of suitable length to fit the window (brass hinges may be bent easily) having the end of the leaf 1 bent up as shown, this leaf when in place being about ¼ inch above the top of lower sash. Any attempt to raise the lower, or lower the upper sash, will cause the leaf 1 to jam and lock both sashes.

The device shown in Fig. 2 is similar to that shown in Fig. 1, except that the leaf 3 is bent at right angles at the middle. This form of catch when screwed to the upper sash about ten inches above the top of lower sash will only allow either sash to be raised or lowered this certain distance. When not in use, the flap 3 may be thrown over to the glass and the windows opened freely.

AUTOMOBILE JACK FROM PIPE FITTINGS.

BY ROBERT H. BROCKMANN.

A very serviceable jack for automobiles may be made out of ordinary pipe fittings, as shown in the accompanying illustration. Take a piece of 1-inch pipe *A*, about 10 inches long, and to one end secure a flange *B*, which will serve as the base of the jack. Within the pipe *A* insert a ½-inch pipe *C*, 12 inches long. This should be threaded throughout its entire length, and the lower end may be fitted with a cap. A bar of iron *D*, about 15 inches long and ¼ by 1¼ inches, is bent as shown in the illustration, and a hole is bored



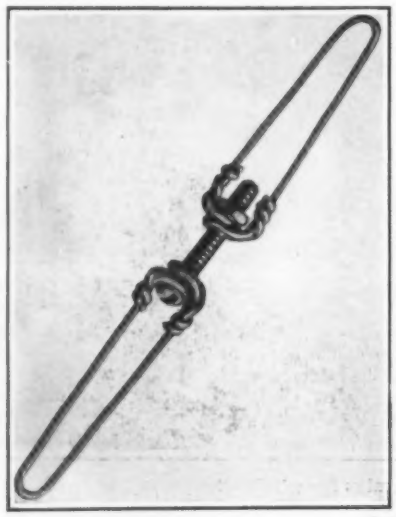
AUTOMOBILE JACK FROM PIPE FITTINGS.

through it, large enough to admit freely the pipe *C*. A flange *E* should be screwed down over the pipe *C* on to pipe *A*. The bar *D* fits over the flange *E*, and at one end is hooked under it. Notches are filed in the edge of the flange to receive a pawl *F*, which consists of a piece of ⅜ by ¼-inch iron 8 inches long. The latter is secured at its center to the bar *D* by means of a screw. In use, as the bar *D* is operated, the pawl *F* engages the notches of the flange, causing the latter to feed the pipe *C* upward. At the top of the pipe *C* is a rest *G*, formed by cutting off a portion of a 2-inch by ½-inch tee. When it is desired to reverse the jack, the pawl *E* is swung about on its axis to engage the notches at the other side of the bar *D*.

IMPROVISED TURNBUCKLE.

To the Editor of the HANDY MAN'S WORKSHOP:

While building a flying machine of the helicopter type I needed a lot of small, light turnbuckles. Not being able to obtain anything suitable, I proceeded to make them out of bolts and wire as illustrated herewith; and found that the improvised turnbuckle answered the purpose nicely. The design might be of



IMPROVISED TURNBUCKLE.

interest to amateur flying-machine builders as an easy and effective way of tightening up the numerous guy cables and braces. The sample illustrated is made of No. 14 soft steel wire, with an ordinary 3/16-inch stove bolt. This turnbuckle will easily stand a strain of 200 pounds.

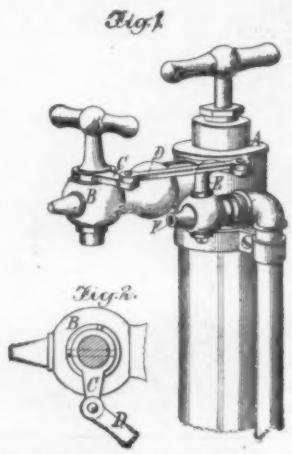
P. P. BELT.

Fredonia, Kans.

AUTOMATIC VENT FOR GASOLINE TANKS.

BY CHARLES BRECHT.

A simple method of venting an underground gasoline tank of the type used in garages is illustrated in the accompanying drawing. The writer has been using this vent and finds that it works to perfection. It consists in coupling a cock on the vent with the spigot of the pump in such a way that the vent will be opened only when the pump is being operated to draw gasoline. The pump *A* is of standard type and is fitted with a spigot *B*. The spigot is flattened to receive a lever *C*, which is connected by a link *D* with the handle *E* of a pet cock *F*, mounted on the vent pipe. As shown in the plan view, Fig. 2, a stop pin is fitted into the spigot, and is adapted to engage the project-



AUTOMATIC VENT FOR GASOLINE TANKS.

ing end of the cross-pin, which secures the lever *C* to the valve stem. This cross-pin is soldered in place. In use, when the spigot *B* is opened to permit of drawing gasoline, the cock *F* is also opened to admit air to the tank, and on closing the pump spigot the vent cock is automatically closed, preventing loss of gasoline by evaporation.

QUICK REPAIR OF PUMP AT TIME OF FIRE.

BY JAMES M. SHERMAN.

On a bitterly cold winter's night, with the thermometer standing at 22 degrees below zero, a fire broke out in a certain Missouri town. The fire had been in progress nearly an hour when the water supply suddenly failed. The water cylinder head of the larger of two pumps in the water works plant had burst because of an insufficiency of water, due to the accumulation of ice around the mouth of the suction pipe. This unfortunate accident left the town at the mercy of the fire with only a small pump not large enough to do much with a conflagration. There were so many fire streams on that when the large pump broke, the water merely dribbled out of the fire nozzles.

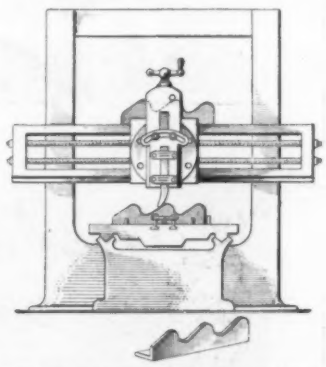
The manager, although sick in bed, was hastily summoned, and he immediately dressed and rushed out to the plant. Arriving in the pump room, he quickly examined the damage to the machine, and then instructed the engineer in charge to hunt for an old piece of sheet iron smokestack that had lain around the plant for a month. In the mean time the manager unscrewed the broken head and had it off when the engineer returned with the pipe. The pipe was cut open and spread out over the broken water head and holes were driven through it with a punch to match the holes in the casting. A rubber gasket was cut out, and put on the stud bolts of the cylinder, after which the sheet iron and lastly the broken casting were put in place, and all screwed up tightly.

The steam was turned on the pump, and the water pressure began to show in the water gage until it pulsated between one hundred and twenty-five and one hundred and thirty-five pounds to the square inch, and sometimes it went as high as one hundred and forty. Word kept coming over the telephone that all was going well at the fire up-town and that it was almost under control. The thin galvanized sheet iron would swell out and draw in about forty-five times a minute with every stroke of the pump, and it looked as if it would burst any minute, but it held for the fire, while the pump was running at a high rate of speed for over an hour, and at normal speed until morning. When examined it was found to be in good condition, notwithstanding the number of times that it had been flexed in and out. It stood the strain without cracking for a couple of days, when the water began to squirt out from a crack on the line of the bending circle. By renewing the temporary sheet iron head several times, the pump was kept at work for more than a week, while waiting for a new head to come from the factory. Little did the public know that water service was hanging by so uncertain a thing as an old piece of smoke pipe not more than one thirty-second of an inch thick.

PLANER JIG FOR GROOVED PLATES.

To the Editor of the HANDY MAN'S WORKSHOP:

In the SCIENTIFIC AMERICAN of August 6th last I saw an article on radius cutting on a planer. Some



JIG FOR PLANING GROOVED PLATES.

time ago our company got an order for large plates of a peculiar shape, and to work out all these radii by hand would have been an awful job, so I rigged up my planer, as shown in the accompanying sketch.

The plates were male and female and had to be as nearly perfect as possible, so instead of having the regular gages made in the tool room, I had jig plates made out of ⅜-inch sheet steel. These I fastened on the cross rail in back of the head, and ratcheted a slide in the head and fitted a pin in it. As the head was fed across the job, the slide with the pin was fed up and down on the jig, making as fine a job as a man could make. The only tedious work was making the jigs, which took the place of the templates we would have needed had we done it by the old way. In doing it this way I saved quite a bit of money for the company, and made a pile of bonus money for myself.

JOE G. ROMIG.

Allentown, Pa.

A KINK FOR SETTING DIVIDERS WITH THE MICROMETER.

BY H. D. CHAPMAN.

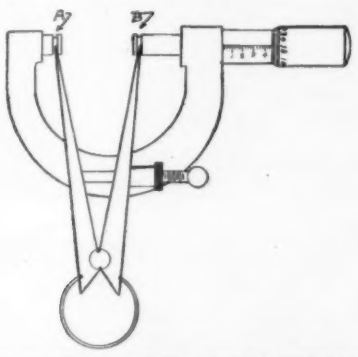
It is not a difficult job to set the dividers to a scale; but when necessary to set the dividers for an exact radius, especially if the size of radius is given in decimals, it is impossible to do it with a scale.

The accompanying drawing shows an extremely handy little kink, which no doubt some of the readers of the SCIENTIFIC AMERICAN will appreciate.

The anvil and the screw are taken off a one-inch micrometer for this operation. These parts are hard, of course, but not so hard that a small groove cannot be cut around the screw and the anvil, as shown at *A* and *B*. A regular thread tool is used for this work. This groove is 0.01 inch deep and 1/16 inch from the

end of the anvil and screw. It is necessary for the groove to be 0.0625 inch, so when the dividers are set it will be to the exact radius. It is rather a difficult job to get the groove exactly to this dimension, but the job can be done as follows: The anvil is caught in the chuck of a lathe, and a facing tool is used for a guide. The tool is placed in the tool post, the carriage is then run up until the face of the tool touches the end of the anvil. The lathe is then geared up for chasing a 16 pitch screw.

With a surface gage, a line is scribed on the rim

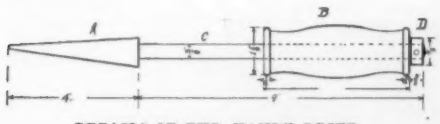


SETTING DIVIDERS WITH THE MICROMETER.

of the face plate. The spindle of the lathe is moved around by hand, until it has made one revolution, stopping on the line which has previously been made with the surface gage. The tool is then run in until the point touches the anvil, and the mark is made around the job. The tool is then taken out, and the chasing tool is placed in the lathe, and by using a jewelers' eyeglass the tool is set accurately in line with the mark which has been made around the anvil. The tool is now run into the depth of 0.01 inch, using the graduations on the cross feed for getting the depth. After the line has been cut on the anvil the screw is placed in the lathe and cut in the same way.

HOW TO MAKE A HANDY DRIFT.

The accompanying drawing shows clearly how a drift can be made. In the ordinary method of taking a drill from a drill press one hand must hold the drift



DETAILS OF THE HANDY DRIFT.

and the other the hammer, and when the drill has been driven loose from the drill press the drill will fall to the floor or strike and scar the drill press table. With the drift here illustrated one hand is free to hold the drill, while the other operates the drift. The drift is made of tool steel and hardened. The drift *A* is placed in the slot of the spindle, and the screw *B* is used as a hammer, sliding back and forth on rod *C*. The drill can be knocked out with a slight blow. A collar *D* is secured to the end of the rod *C* to prevent the sleeve from dropping off.

SMALL LATHE MADE OF A SEWING MACHINE.

BY KENNETH RICE.

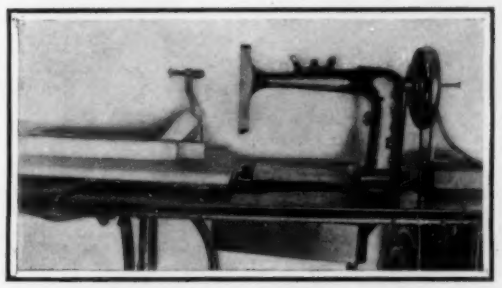
The accompanying illustration shows an old-fashioned sewing machine transformed into a small woodworking lathe which is capable of turning cover handles, spools, and, in fact, all sorts of small articles. Although the headstock is on the right side, contrary to that on the manufactured lathe, this causes no serious inconvenience.

The plate that fitted over the chamber in which the needle holder vibrated was removed, and likewise the eccentric that was on the end of the shaft and operated this holder. The shaft with the small pulley and flywheel was then removed from the head of the machine. In the end of the shaft opposite that occupied by the pulley a ⅛-inch hole was drilled to the depth of about ½ inch (the material of which the shaft was made being comparatively soft). In this hole was inserted a soft iron pin that fitted very tightly and protruded ¼ inch. The shaft was put back into its bearings and the belt put on the pulleys. The protruding end of the pin was filed to a point by holding a file against it while it was being revolved by the treadle. The shaft was again removed and four deep furrows were filed, leaving a projection at each quarter of the shaft. These projections were then sharpened to grasp the wood to be turned.

After the eccentric was removed from the end of the shaft, there was nothing to prevent the shaft from sliding out of the bearings. To prevent this, a shelf bracket was set up so that the hole on the free side was directly opposite the center of the shaft. A bolt was inserted in this hole with the threaded end bearing on the shaft, and was fastened by a nut on each side of the bracket.

Then a ⅝-inch maple board, measuring 1 by 2 feet was prepared, and two pieces of 1½-inch square material nearly the length of the board were secured to the board, parallel and 1½ inches apart. Half way between these a slit was made, 5/16 inch wide by 13 inches long. These two parallel pieces together with the slit were to receive the tailstock, and permit its being adjusted to different distances from the headstock.

The tailstock was made out of a part of the machine which had a threaded end to receive a thumb screw. The threaded part was slotted, so that by means of a second screw situated below the thumb screw the

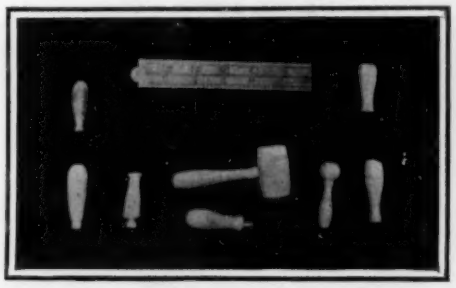


SMALL LATHE MADE OF A SEWING MACHINE.

latter could be clamped. To the end of the thumb screw, which was sharpened to a point, was fastened, by means of a set screw, a small piece, shaped somewhat like a hollow truncated cone, that came from some part of the machine. This made an ideal tail center. The whole arrangement was fastened to a piece of 1½-inch material in a simple way, as shown.

A hole was bored in the base of the tailstock to receive a bolt, which was passed up through the slit in the board, and which was to hold the tailstock tightly when it was adjusted to the required position, the thumb screw being used for the finer adjustment. Lastly, the large board was bolted securely to the machine top about half an inch from the top, to allow the free movement of the bolt head beneath the board.

A few of the articles turned on this home-made lathe are pictured herewith. While the lathe does not take anything of a large diameter, yet there are

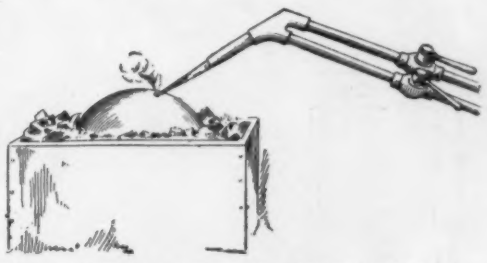


WORK OF THE SEWING MACHINE LATHE.

many small articles which can be made nearly as well with this lathe as with a manufactured one, the principal difficulty being the slow speed.

A COPPERSMITH'S WRINKLE.

In brazing the joint in a perfectly tight receptacle, say a spherical copper float, it is necessary to make a small vent, and this vent is the last bit of brazing which seals the receptacle airtight. To make it possible to braze the vent, the copper float has to be placed in a box and packed around with ice, otherwise the brazing will be a failure, as the internal air becomes heated and thereby produces a pressure that causes air bubbles in the brazed seal. It could probably be



BRAZING THE VENT IN A COPPER FLOAT.

soldered with a soldering copper without the ice, but not brazed, which is necessary on some work.

Shop Notes.

To make a wax for metal patternmakers' use: Rosin, 1 part; beeswax, 1 part; plaster of Paris, 1½ parts. Heat the wax and rosin and stir in the plaster of Paris, then add lampblack to make the desired color. Apply this wax with a heated knife. After taking an impression of a casting with plaster of Paris, by pouring molasses water around the edges, the plaster will be loosened so that the cast can be removed without injuring it. The molasses water will cause the plaster to stick to itself and not the pattern.

When the belt has become oil-soaked and will not stay on the machine, a good method of cleaning it is as follows: Coil the belt loosely in a tub of sufficient size, and cover with whiting. Be sure that the whiting gets in between the coils of the belt, and it will be only a short time before the whiting will absorb the oil from the leather. It will then only need to be wiped clean to be ready for further use.

The following formula will be found very handy for coloring brass a deep blue: Copper carbonate, 6.4 ounces; ammonia hydrate, 3,200 cubic centimeters; water, 1,600 cubic centimeters. The brass parts must be cleaned and freed of all grease. A good way to clean them is to dip them in gasoline. When clean, dip the brass into the solution, and let it remain therein about ten minutes. Then take it out of the bath and rinse in clear water. The brass will have a deep blue color, which will not tarnish or rub off.

SOME THREAD-CUTTING KINKS.

BY A. F. BISHOP.

In a machine nut tap the thread is cut to a uniform and parallel depth for its full length and the points of

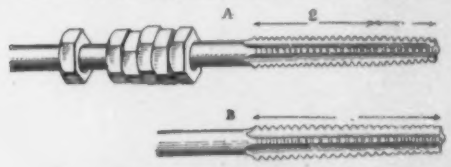


Fig. 1.—IMPROVED MACHINE NUT TAP.

the thread are ground down to make a long taper as shown at *B* in Fig. 1. Mr. W. S. Bishop, when using the machine nut tap, was more or less annoyed by the breaking of the tap. He overcame the trouble by cutting the thread on the tap tapering for about one-third of its length, as indicated by the arrows marked 1, while the remaining part marked 2 was cut parallel. The points of the thread were ground off tapering in the ordinary way.

Fig. 2 shows how a left-hand thread can be cut

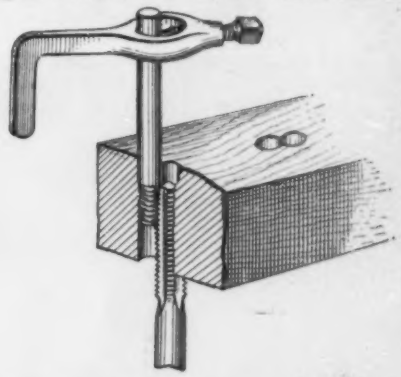


Fig. 2.—CUTTING A LEFT-HAND THREAD WITH A RIGHT-HAND TAP.

with a right-hand tap. Two holes are drilled in a very hard piece of wood in such a manner that they cut into each other. The tap is screwed into one and held rigid. The other hole serves as a guide for the rod that is to be threaded, causing the rod to bear against the outside cutting edge of the tap. By turning this rod in a left-handed direction a left-hand thread will be cut, both the pitch and cutting edge of the tap coming true for this purpose.

Another method of cutting a left-hand thread by the use of the right-hand tap is shown in Fig. 3. Take a four-fluted right-hand tap and grind off two opposite cutting edges. On considering the remaining two cutting edges it will be observed that the point of the thread on one side is just midway between the points on the opposite side as shown by the dotted

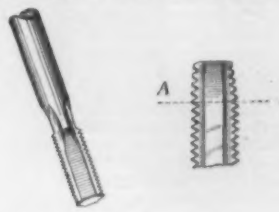


Fig. 3.—TAP FOR RIGHT OR LEFT-HAND THREADS.

line marked *A*. This form of tap with two cutting parts will make either a right or left-hand die, the pitch being so short on the cutting edge that by using considerable pressure when desiring to cut a left-hand thread, it will do the trick. The writer has tapped steel and brass successfully by this method.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

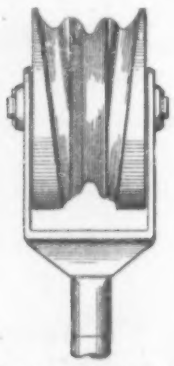
FOOT-SUPPORT.—Dr. A. D. FRENCH, Shelton, Conn. The object of this invention is to bring the weight of the body on the heel of the foot, where it properly belongs, and to prevent the foot from turning and thereby preventing the arch from lowering, rather than positively supporting the arch as commonly done, which latter takes the weight away from the heel.

VENTILATOR FOR HATS.—J. M. DAVIES, Plattsburg, N. Y. This invention relates to means for introducing air within the crown of a stiff-bodied hat, and the object is to provide a ventilating device which is actuated automatically by the wearer while walking, and causes a pulsating current of fresh air to circulate in the upper portion of the hat body.

Electrical Devices.

TROLLEY-HARP.—R. D. BLACKSTONE, Muskogee, Okla. The purpose in this case is to provide a device that will closely follow the curves and inequalities of the feed wire and will afford a greater amount of resistance to dislodgement than the usual form, and which may be cheaply constructed, easily assembled and disassembled and easily operated.

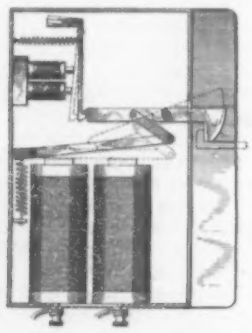
TROLLEY HARP.—LEWIS E. BRADY, 832 Security Building, Los Angeles, Cal. The device is adapted to lessen the liability of disengagement of a trolley wheel from the wire, and to catch the wire and guide it back to



IMPROVED TROLLEY HARP.

the wheel. It comprises a pair of auxiliary wheels, one at each side of the trolley wheel, which are grooved eccentrically, with the planes of the grooves inclined, and converging toward the trolley wheel, so that the wire riding in either direction of the grooves will be brought back to the proper position.

LOCK.—FRANK WALTERS, care L. E. MICHAEL, Box 1775, Spokane, Wash. The lock here illustrated is adapted particularly for use on elevators. It is electrically controlled, and comprises a pair of magnets, one



ELECTRICALLY CONTROLLED DEAD-LOCK.

of which controls the latch, while the other operates the deadlock. The push button for energizing the magneto is located on the elevator and is under control of the elevator operator. The object of the device is to prevent accidents caused by careless or intoxicated persons who might open the door while the elevator is still in motion.

Of Interest to Farmers.

BAND-CUTTER FOR THRESHING-MACHINES.—J. T. HANSON, Sioux Falls, S. D. In this patent the improvement is in band cutters for threshing machines, and the object is to provide a cutter of this character for use as an attachment to the feeding device, which will be of simple construction, and which will automatically adjust itself to bundles of various sizes.

PLOW.—C. R. HARRYMAN, Shawnee, Okla. The present invention has in view an irrigating plow having a knife for use in cutting the slot, applied in front of the plow beam, the knife and share being detachably connected to each other, and to the beam, whereby they can be removed for grinding, renewal, etc.

Of General Interest.

DESK.—H. M. LEESE, Washington, D. C. This improvement is in the locking means for desks, and relates particularly to that class illustrated in a former patent granted to Mr. Leese. An advantage is that when the slide rod is adjusted to lock one or more of the drawers, the locking devices corresponding to other drawers may be out of locked position, and the inventor also provides means so that the drawers cannot be unlocked by turning the desk upside down. The means for locking the rocker forms the subject-matter of a patent granted to Mr. Leese, on an improvement in locks.

LOCK.—H. M. LEESE, Washington, D. C. This improvement in locks is a division of a former application filed by this inventor for improvement in desks; wherein the rocker may be locked from movement and whereby the key mechanism for unlocking the rocker may be utilized in turning the rocker in securing the operation of the parts as desired.

COLLISION-SHOCK-ABSORBER FOR SHIPS.—J. PATRONAGGIO, New York, N. Y. The invention has for one of its purposes the provision of means which will not impede the vessel when driven through the water and while not weakening the construction in other respects, will absorb the shock and prevent injury should the ship run down another vessel or be run down.

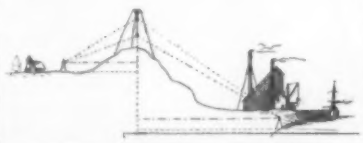
OIL-STRAINER.—J. T. BOND, Palatka, Fla. This invention will remove sediment and other impurities from gasoline, kerosene and other hydro-carbons, and will stop the passage of water with the hydro-carbon so that the last will be delivered to the point for use free of sediment and the like and without water so it will operate effectively for the purpose.

SHOE-GUIDE FOR WELL-CASINGS.—A. C. GRAHAM, Oilfields, Cal. This guide is constructed with a tapering guiding head to easily pass within the casing, and has a neck adapted to fit tightly within the shoe, the entire guide being in the nature of a shell of cast iron or other material more readily fragile than the casing or the shoe, so that when the shell is knocked from the well casing it is easily crushed into fragments in the well and afterward removed.

FORM FOR BUILDING CONCRETE STRUCTURES.—D. M. DULLER, Houston, Texas. The improvement is in forms for building concrete structures. The object is to provide a form more especially adapted for figures circular in cross section, and composed of a plurality of strips hinged edge to edge, wherein the width of the individual strips bears a constant ratio to the unit of measure.

REEL-CRADLE.—H. B. CARTER, Springfield, Vt. In view in this invention is a cradle on which wire cable, flexible pipe, etc., are wound, constructed to engage the journal of the reel when the reel is resting on the ground or other surface, in which the reel is raised so as to be freely rotatable on the cradle as a support, the raising of the reel requiring little exertion for those of considerable weight.

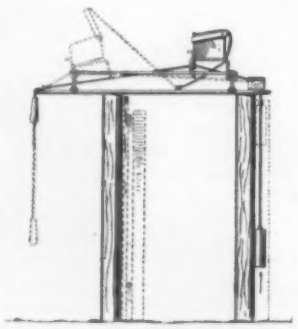
SURVEYING APPARATUS.—MARIO W. TERYRIÇÁ, Caixa Postal 224, Sao Paulo, Brazil. The invention provides a new method of surveying by reference to two or more sight points vertically spaced and supported by an aerial apparatus. The latter, which the inventor calls a "ballometer," consists of a conical balloon, from which are suspended the two sight points. The balloon is held at a fixed height by means of guy wires. The



SUSPENDED SIGHTS FOR SURVEYING.

accompanying drawing illustrates one method of using the device. There are many other possible methods involving the use of one or more ballometers.

MAIL BOX PROTECTOR.—EUGENE B. EGGLESTON, Sheridan, Ill. A new support for mail boxes, designed to be used upon rural



MAIL BOX PROTECTOR.

free delivery routes, is here illustrated. The box may be moved automatically from the position in which mail is introduced into it, to a position of safety, so that it is beyond the reach of stock or meddlesome children. It may be moved from the outside of a fence to the inside, thereby obviating the necessity of the patron's going around through the gate to the other side.

Hardware and Tools.

DOOR-LOCK.—S. SCHACHT, New York, N. Y. The invention relates to door locks having a locking bolt and a latch, and the object is to provide a lock for use on entry doors of apartments, dwellings and other buildings, and arranged to permit of successfully retracting the bolt and the latch by the same key-controlled mechanism whenever it is desired to open the locked door from the outside and at the same time the latch is locked against retraction by the door knob and its spindle.

ADJUSTABLE LEVEL.—H. A. E. COY, New York, N. Y. In the present patent the object of the improvement is the provision of means whereby the position of the tube may be altered in respect to the body of the level after all of the parts have been assembled. Mr. Coy's improved adjusting means may be used also with levels in which other devices than spirit tubes are employed.

Heating and Lighting.

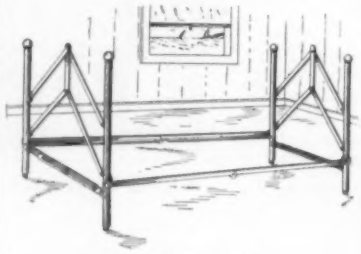
BAKING WITH QUICK HEATING AND COOLING.—F. VIRGILI, Genoa, Italy. This invention relates to a furnace for making bread and other alimentary substances, with an external combustion chamber, that is to say, with a combustion chamber placed outside the baking chamber having all the advantages of furnaces with inner combustion chambers in which the heating is effected by lighting the fire in the baking chamber itself.

HOUSE-HEATING BOILER.—M. F. KENELY, Elizabeth, N. J. The object here is to provide a boiler more especially designed for use in houses for heating the same with steam or water, and arranged to utilize the fuel to the fullest advantage, to insure quick circulation of the water, and to permit convenient cleaning and making repairs.

FUSE-IGNITER.—R. CONINGS, Pittsburg, Kan. The invention relates to igniters for use in mines and the like to ignite the fuses used to detonate blasting or other explosive charges, and more particularly relates to a fuse igniter having an igniting chamber, means for introducing the end of a fuse into the chamber, and means for igniting the fuse within the chamber so that no flame or spark can escape from the device.

Household Utilities.

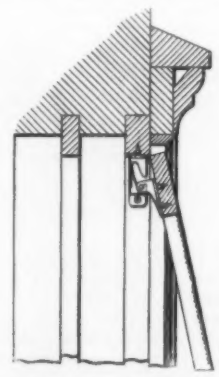
FOLDING BEDSTEAD.—E. L. ELLIOTT and WILLIAM H. SCHRODER, Box 196, Coquille, Ore. The object of the invention here illustrated is to provide a bed which may be folded into small compass and which may be contracted or expanded laterally to form a single or double bed. The four bedposts are connected by side rails and end rails. The side rails



FOLDING BEDSTEAD.

are hinged, while the end rails are arranged to slide one upon the other. In addition to this, there are hinged links at the ends of the bedstead which will fold as the posts are moved toward each other. The bedstead may be secured and locked at the desired adjustment by means of thumb screws.

SASH HANGER.—HARRY P. SARCHETT, Nowata, Okla. An improved sash hanger is shown in the accompanying engraving by means of which storm sashes, screen frames, and the like can be mounted in position in



IMPROVED SASH-HANGER.

the window frames from the inside of the building. They are thus protected from the weather by the window frame itself, thereby obviating rust streaks or other disfigurements of the building. The construction is such that the frames are mounted pivotally and may also be removed readily.

FOOT AND LEG REST.—J. A. GAERTNER, Boston, Mass. This invention which relates to combined foot and leg rests is an improvement on the device disclosed in a former patent granted to Mr. Gaertner. It provides a leg rest which may be readily attached to a chair and which is pivoted at both ends to permit a relative movement of the rest, chair and oscillating support.

ADJUSTABLE RECLINING-CHAIR.—A. D. LUEDDERS, Sturgis, Mich. The chair is provided with a fixed seat and a back adapted for adjustment at different angles of inclination from the seat. The object is to provide a chair which can afford convenient means for releasing the back of the chair for its inclination at the proper angle, and for automatically locking the back securely when it is inclined at a desired angle in relation to the seat.

Machines and Mechanical Devices.

LEVEL.—H. O. EARMAN, Manhasset, N. Y. In this patent the invention pertains to levels, the purpose being the provision of a level having a stock made practically of sheet metal so formed as to accommodate itself to the various parts to be supported. It further relates to various details of mechanism, the general purpose of which is to improve the general efficiency of the level.

WEIGHING-MACHINE.—J. M. CHAPPEL, New York, N. Y. The intention here is to provide a machine unlimited as to the number of loads put on the weighing platform by the use of a spring actuated mechanism, the spring of which is automatically wound up, and means are provided for preventing overwinding or underwinding, thus insuring a proper functioning of the machine without requiring any attention.

DIVIDING APPARATUS.—R. HOYT, New York, N. Y. This invention refers to apparatus for dividing material into definite quantities, it being especially adapted for separating such a plastic as dough into lumps of a substantially fixed weight. Its principal objects are to provide a convenient machine which will automatically perform operations of this character.

APPARATUS FOR PRODUCING CORRUGATED METAL SHEETS.—G. B. JOHNSON, London, England. The object of the invention is to provide a machine with means for shaping the outer flank of the outermost corrugation at each side of a corrugated sheet in such manner as to render said corrugation of sharper curvature than the rest of the corrugations, so that its flank is more nearly perpendicular to the general plane of the sheet than heretofore.

DRIVING MECHANISM.—J. DUITCH, Farmington, W. Va. The mechanism embodies a shaft, a clutch, and a pulley or other belt or driving wheel, with the clutch associated with the wheel and shaft to connect and disconnect them at will. The aim is to relieve the shaft of strain on the wheel incident to pull on the belt, and also prevent wear between pulley and shaft so that these parts constantly remain concentric and insure an accurate centering of the clutch members.

Prime Movers and Their Accessories.

VALVE MECHANISM AND GOVERNOR.—G. P. RANDOLPH, Jennings, La. This improvement refers to valve mechanisms and governors for internal combustion engines and the like, and relates more particularly to a device of this class in which the governor, through the valve mechanism, so controls one of the valves of the engine that the latter can receive an explosive charge at any induction stroke after the exhaust or scavenging stroke.

COOLING DEVICE FOR INTERNAL-COMBUSTION ENGINES.—R. B. VAUGHN, Wilkes-Barre, Pa. This invention pertains to certain improvements in cooling devices for internal combustion engines, and more particularly to that type of cooling device in which water is circulated in the jacket of the engine and then withdrawn and cooled by direct contact with the air.

IGNITER FOR GAS OR OTHER INTERNAL-COMBUSTION ENGINES.—G. Z. SMITH, Salt Lake City, Utah. An object of this invention is to provide a novel means for cleaning the spark terminals without removing the same from the engine, or without stopping the engine. A further object is to provide a plurality of contact points which may be removed separately so that one or more may be used, as desired.

STARTER FOR INTERNAL-COMBUSTION ENGINES.—D. S. ANTHONY, Durango, Mexico. The starter has a drum which may be connected by a cable or other flexible transmission means with a pulley or an engine shaft, there being means adapted to rotate the drum on which the cable is wound, the engine shaft being adapted to slip from a recess in the pulley in which it is disposed, when the starter is used.

VALVE MECHANISM FOR COMPOUND ENGINES.—P. O. POULSON, Brigham, Utah. This invention relates to certain improvements in compound reciprocating engines and more particularly to the valve mechanism for controlling the admission and exhaust of the steam or other expansible motive fluid. A slide valve controls the admission and exhaust of steam to both the cylinders and helps to insure the operating of the two cylinders in unison.

Railways and Their Accessories.

INSULATED RAIL-JOINT.—E. C. ZIMMERMANN, New York, N. Y. The invention relates to insulated rail joints, the more particular purpose being to provide means for connecting together two adjacent rail ends by aid of a metallic plate insulated therefrom, that this metallic plate may be used for forming a part of an electric circuit used in signaling and associated with the rails.

CONNECTION FOR ELECTRIC CARS.—J. V. DOYLE, New York, N. Y. An object of this inventor is to provide a flexible connection between the car body and the motor on the car truck, which will allow for all motion of the truck relative to the car body, and will also be automatically disconnected when the body of the car is jacked up, without the necessity of laborious manual manipulation.

RAILROAD JOINT-CHAIR.—P. RADOMAN, Red Lodge, Mont. A purpose here is to provide a chair form that adapts it to incase the base flanges and webs of two track rails at adjacent ends thereof; and also to provide means for securing the chair on the rails so as to render them practically continuous and perfectly alined, thereby preventing any jar at the rail joints when traversed by heavy trains.

METALLIC RAILWAY CROSS BRIDGE, AND SWITCH TIE AND FASTENING.—J. W. CLUBB, Paris, Ill. The object of this inventor is to provide a metallic tie and rail fastening by which rails will be held more securely than heretofore, and without the aid of screws, bolts, nails, wedges, or similar adjunctive devices. The fastening is likewise so constructed as to prevent "creeping" of the rails.

Pertaining to Recreation.

GAME APPARATUS.—E. R. ERNST, New York, N. Y. The object here is to provide an apparatus to afford amusement, entertainment and instruction to children as well as adults, which can be employed for the playing of games by different numbers of players, with which different sets of rules governing the playing thereof can be employed, and which is compact in form, so that it will take up little space when not in use.

Pertaining to Vehicles.

HORN.—E. TESTE, No. 16 Rue des Bois, Paris, France. This invention consists essentially in the employment of a distributer adapted to direct the blasts of air, successively expelled from the bulb, through the reeds of one or more horns, said distributer being actuated by means of a pawl operated by the bulb itself and acting upon a ratchet wheel attached to the distributer.

VEHICLE-WHEEL.—S. M. FRIEDMAN, New York, N. Y. The main object of the invention is to so construct the inner annular air chamber that the air may be retained therein under pressure as efficiently as it can be in an ordinary pneumatic tire. To accomplish this, an annular air cushion or air bag of flexible material is provided, for instance, rubber, and so disposed in relation to the spokes of the wheel that they all are held outwardly by the pressure within the cushion.

COUPLING FOR NECK-YOKES AND VEHICLE-TONGUES.—D. S. DILLENBACK, Hastings, Neb. In the usual form of couplings for neck-yokes and tongues, the latter project beyond the yoke. In some attachments, however, the neck-yokes and tongues are so connected by a locking joint that this objection is avoided. The improvement is in this line, whereby a coupling is produced having advantages in respect to operation, strength, and durability.

MUFFLER CUT-OUT FOR AUTOMOBILES.—H. MCCLEARY, Washington, D. C. This invention has for an object the provision of a construction whereby the discharge from an engine to the muffler may be cut out in advance of the muffling device, affording a free discharge whenever desired, for the purpose well known to those skilled in the use of this class of devices.

WHEEL.—R. D. MOON, San Angelo, Texas. It is claimed that this wheel is superior to any other in strength because of its construction in fellies, tire and spokes, where other wheels are weakest. In this, there is no splitting of fellies, tire running off, etc. The wheel can be more easily made, will be more durable and more easily repaired. The tire covering the sides of the felly and being riveted at the spokes will add the same strength to the rim as the iron flanges add to the spokes in the patented hub.

Designs.

DESIGN FOR A RECEPTACLE FOR TOILET COMPOUNDS.—E. HORTER, New York, N. Y. In this design the receptacle is delineated in two sizes, but of identical style of surface ornamentation, which consists of an arrangement of sprays or stems extending more or less in vertical direction and bearing representations of the violet flower.

DESIGN FOR A MUFF.—J. KARPELES, New York, N. Y. In this ornamental design for a muff the front and side presentations represent a long-haired dog with ribbon and bows across the head.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12297) M. R. says: When looking over the top of a hot stove at a chair on the other side of the stove, along a line parallel to the top of the stove, parts of the chair seem to possess a wavy motion. We say this is caused by the heat radiating off into the air. Now it is quite generally accepted that all light consists of ether waves, and yet that human eye cannot see these waves. Since the chair on the other side of the stove seems to vibrate when in reality it does not, then the light waves which are passing from the chair to the eye are being disturbed somewhere on the way, or over the stove. We can see these radiations passing off from the stove. If it is the vibrations of the air which we see, then the ether which surrounds every molecule and atom of the air must also be vibrating at the same rate, because the apparent vibrations of the chair correspond to those over the stove. Unless this argument is faulty, we can see the vibrations of the ether. A. When one looks over a hot stove and sees the streaming motion beyond, as shown in the refraction of the light and distortion of the parts of a chair, it is not directly the vibration of anything which is seen. The effect is due to the convection currents set up in the air over the heated stove, by which the light from the different parts of the chair is refracted and reaches the eye from different directions, so that the parts of the chair seem to have been bent or broken. The vibrations of ether have not been directly seen by anybody. They far transcend the ability of the optic nerve to transmit to the brain. The convection currents in the air have a very slow motion and can be seen in many ways. The drifting of smoke is one of the easiest methods of making them visible. All winds are convection currents produced by the heat of the sun, and drifting of clouds over the face of the sky makes these currents of air visible.

(12298) D. H. D. says: May not the right ascension of a star or comet be approximately estimated without the aid of an almanac, instrument, or chart, by reckoning east from the meridian to the point of the star or comet? A. Right ascension is, as you doubtless know, the distance reckoned in time from the intersection of the equator and the ecliptic upon the celestial equator to the hour circle of the heavenly body. It is the time which has elapsed since the vernal equinox crossed the meridian to the crossing of the heavenly body over the meridian. It is usually obtained by means of a clock which has been adjusted to keep sidereal time. The time by such a clock will always be the right ascension of the vernal equinox. Every astronomical observatory has a clock keeping sidereal time. The right ascension of a comet or star would be found in an observatory by means of a transit instrument, taking the time of its passage over the meridian. An estimate of the distance of a star from the meridian by the eye will be the right ascension of the star only when the vernal equinox is on the meridian of your place, and this estimate will be very crude and inaccurate.

(12299) H. W. K. says: I wish to make an induction or shock coil. I have tried every way I can think of, and have not succeeded. I have used between 7 and 14 dry batteries, but cannot feel the slightest shock, although they will produce bright sparks. Would you kindly direct me as to construction and electrical connections? Have you any SUPPLEMENTS on this subject? A. We would answer your request for instructions in making a shock coil by saying that we printed the full description with eight diagrams in our SUPPLEMENT No. 1806, which we will send for ten cents.

(12300) A. E. W. says: Kindly let me know, in constructing large office buildings, who are the first men on the job? Has the architect or the mechanical engineer full control over the structure? Have the bricklayers anything to do with the foundation? Has the foreman of the bricklayers anything to say about the iron work? Is a bricklayer a mason? Can the bricklayers go ahead of the iron workers if the latter go on strike? That is to say, can they lay brick first and the iron work after it? What is the draughtsman's duty? A. We hardly know how to answer your questions. It depends upon whether you are asking for conditions as they are or as they ought to be. For instance, neither architect nor engineer should have full control over the design of large steel-construction office buildings, yet either one sometimes does actually control and override the other, so that a monstrosity in operation or in use results. Bricklayers may be employed on the foundations if the latter are of brick construction, but often concrete or stone masonry is used exclusively. The various foremen often have a good deal to say about the steel work, but the steel workers are not under the jurisdiction of any but steel-working foremen. Generally, the brickwork of each story is supported upon an angle at the base of the story, so that nothing could be done in advance of the steel work, even if "sympathetic" principles would permit bricklayers to work during a difference of opinion between steel workers and employers. The draughtsman's duty is to lay out what the engineers in charge direct. Some draughtsmen are competent to assist by making calculations, or designing details of architectural or metal work, but the draughtsman's duty is primarily to do as his employer directs, up to the limit of his capability.

(12301) E. S. S. says: If a spring is made 3½ inches high, with the diameter of the coil 3 inches, the amount of strain or weight the spring will sustain depends on the diameter of the wire used and the class, quality, and kind of wire used. Please inform me how much weight this spring will sustain? Also instruct what *wire* is most durable, and its relation in action to varying temperatures in supporting strains. A. Clark's formula for the dimensions of a steel spring for practical purposes may be expressed as follows:

$$D = 3\,\frac{wd}{8}$$ for round steel wire.

$$D = 8\,\frac{wd}{4.19}$$ for square steel wire.

In these formulas, D is the diameter of the steel wire in *sixteenths* of an inch, d is the diameter from center to center of the coil in inches, and w is the weight in pounds to be borne by the spring. In general, the weight that can be supported without overstraining the springs depends upon the modulus of elasticity of the wire, the diameter of the wire, and the diameter of the coil. The deflection per coil depends on the same figures. The total deflection of the spring is the product of the deflection of one coil multiplied by the number of coils. The stiffest and strongest metal for springs is steel. This will be the most durable, except under the action of rust, in which case a bronze spring may be preferable. All spring metals soften and become weaker with heat, even below the temperature necessary to draw the temper or melt the metal. Thus, the mainspring of a watch is weaker in summer than in winter, and the watch tends to run slower in consequence; the effect being increased by the softening of the hairspring, so that other means are provided to counteract this irregularity in fine watches. The safe load for a spring of 3 inches in diameter, center to center of coil, by 1 inch diameter of steel wire, is 4.096 pounds, approximately. Each coil would deflect under this load from 0.0008 to 0.0011 inch per coil, the exact amount depending on the stiffness of the particular steel used. You can calculate the strength of any spring by the formula given above.

NEW BOOKS, ETC.

THE SCIENCE OF POETRY AND THE PHILOSOPHY OF LANGUAGE. By Hudson Maxim. New York: Funk & Wagnalls Company, 1910. Large 8vo.; 294 pp.

This is an age of criticism, destructive and constructive, and the author, in dealing with a difficult and greatly misunderstood subject, applies both methods. There is certainly no branch of the literary art with regard to which there is more misconception or that is so clouded with nebulous ideas as this. It is fitting, therefore, that a considerable portion of the work should be devoted to showing "what poetry is not," and one of the most valuable portions of the book is a chapter bearing that inscription. "No other subject has been made the victim of more definitions that do not define than has poetry. . . . Guided by the bookish definitions of the critics, we are forced to conclude that poetry is something transcending comprehension. . . . In most lay minds, and even in the minds of many esteemed as authorities, there is no well-defined idea as to what constitutes a poet. They know not whether he should be regarded as a person differentiated from others by virtue of a superior literary genius and attainment, . . . possessing greater wisdom, etc., . . . or whether he should be deemed a species of freak, a human curiosity; . . . a Caliban afflicted with a kind of periodic hysteria or frenzy, the *cacoethes scribendi*, under the influence of which he is compelled to write poetry." Then follows a list of attempted definitions of poetry, which, in its variety and inadequacy, does certainly sustain the author's claim that we need a comprehensive definition. "Poetry," says Carlyle, "is the attempt which man makes to render his existence harmonious." Wordsworth calls it "the breath and finer spirit of all knowledge." "Poetry is the mixture of a lie that doth ever add pleasure," says Sir Francis Bacon; while Lamartine calls it "the morning dream of great minds." Mr. Maxim, who is widely known for his work in high explosives, naturally has an instinctive eye to the structural or mechanical elements of the problem, and he defines poetry as "the expression of insensuous thought in sensuous terms by artistic trope," a definition which, although it would cover equally well certain forms of oratory and lofty and imaginative prose, is very much better than any of which we know. Limitation of space prevents any detailed reference to a work which must be regarded as a notable contribution to the literature upon this subject. It is the pioneer work of its kind in a field in which the clear thinking, keen analysis, and dynamic criticism in which the book abounds were sadly needed. The original style of the author, with its spice of grim humor everywhere present, saves the work from monotony, and renders every chapter eminently readable. The earlier portion deals with foundation principles and the evolution of analogical speech. This is followed by chapters showing what poetry is and what it is not. The author concedes that, owing to the long employment of the word *poetry* to include language both tropically expressive and tonally impressive of thought, there is no serious objection to the continuance of the use of the word in that sense. In that event, however, he advocates the employment of new and scientific terminology. He gives the name literary, derived from the Latin word *litera*, to indicate plain, literal non-emotional statement; and potentry, derived from the Latin word *potens*, to indicate language more than ordinarily tonally impressive; and as the basic principle of verse is time, he terms verse tempotentry; and when language is especially replete with trope or artistic figure, he terms it tropetry; and when verse, or tem-potentry, is replete with trope or artistic figure, he terms it tro-tem-potentry. The author has added to the book some twenty pages of great poetic lines, which are admirably chosen for the purpose of illustrating the principles laid down. The work, which is enriched with sixteen excellent illustrations by William Oberhardt, has a message, not merely for the poets, but for teachers of rhetoric, journalists, and all those whose field of work lies on the public platform.

DR. KURT FLOERICKE. Saeugetiere fremder Laender. Stuttgart: Kosmos Gesellschaft der Naturfreunde. Franckh'sche Verlagshandlung, 1910.

Legal Notices

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Loom dobby, W. Kahre 971,846
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DEEP EXCAVATION BY BORING.

(*Continued from page 292.*)

somewhere near the limit of the diameter of such a pilot shaft. Upon removing the corresponding trepan a second one cutting to the full diameter may be employed. With just double the diameter, this tool will have to excavate three times the amount of material. It is very heavy indeed, but it is operated in pretty much the same way. However, the cutting edge is not horizontal but slopes down toward the center from each side. The annular shelf upon which it operates will consequently slope down toward the center and thus free itself of the spoil by the aid of gravitation and the fluidity of the wet and detached material. The spoil drops into the pilot shaft. It would seem that the larger trepan might be operated almost without clogging. However, it is perhaps best not to allow the material dropping into the pilot shaft to accumulate to too great depth and thus obstruct its own removal.

Two of the great advantages of this method of excavating are the facts that men are not required down in the shaft and that the water need not previously be removed. These are of enormous importance. In fact, it is probably largely because of these reasons that this method seems to have had no real failures.

But just boring the hole is not sufficient. In many cases, it has to be lined with iron or other material. Consider what this may mean for a shaft whose bottom is 1,000 feet below the water level. The hydrostatic pressure increases at the rate of 0.433 pound per square inch for every foot of depth, so that at the bottom of the shaft we should have the enormous pressure of 433 pounds per square inch. The lining at the bottom would consequently have to be very strong. And so the rings of cast iron are made into a very heavy wall. Still it has been found that despite the fact that the specific gravity of iron is about 7½ times that of water, the total of water displaced weighs something more than the iron shell; that is, for rings whose walls have only to resist the hydrostatic pressure of moderately deep shafts. Advantage is taken of this fact in putting the lining in place.

We will suppose that the shaft has been bored or otherwise excavated to the depth required and that the water has risen in it to its full level. Two large shells are arranged to telescope, the one within the other. Upon the exterior there are two horizontal flanges, one above and the other below. One belongs to one shell, the other to the other, so that when the two shells are suitably placed, there is an external space of the form of a cylindrical shell whose height may be shortened by permitting the one shell to telescope farther into the other. This space is filled with moss, which is kept in place by being bound on. This whole arrangement is called the *moss-box*. A ring or two of lining is added at the top and a diaphragm divides the interior into an upper and a lower chamber. The object of this diaphragm is to shut off the water from entrance into the shell of metal as it is added to and the whole lowered down into the water in the shaft. All the joints are made sufficiently watertight by the use of lead packing. The moss-box arrangement with its diaphragm is carefully lowered by means of lowering rods fitted with jacks. When the top is conveniently situated, the whole may be temporarily held in place, while one or more rings of lining are added. Further lowering then takes place, and so on until the weight of water displaced by the shell closed by the diaphragm is equal to or exceeds the weight of the metal. It may then become necessary to force the lining down. However, a central tube running upward from the diaphragm may be used to admit water as desired, and thus control the buoyancy or net weight of the lining. It will be understood that the external diameter of the lining is comfortably less than the diameter of the hole, so that there will be no side friction. It will also be seen

that the moss-box and the several rings will have to be sufficiently strong to withstand the hydrostatic pressure corresponding to their final levels; and that the thickness of the metal wall may be diminished as the lining grows.

When the moss-box has reached the bottom, a tremendous weight may be imposed upon it by permitting water to enter the lining shell. This will have the effect of further telescoping the two parts and so forcing the moss out to fill the space between box and shaft wall. By this means the pressure of the water above is cut off, so that if this procedure is accomplished in an impervious stratum, the further entrance of water within the lining will be stopped. Consequently, the lining may now be pumped out, the diaphragm and central piping removed, and the exterior space concreted up. The lead joints too may now be thoroughly calked.

This method has received very thorough testing abroad under severe conditions. In case it is desired to go to extraordinary depths below the hydrostatic level, a complication comes in. The pressure exerted by a column of water 2,000 feet high amounts to 866 pounds per square inch. In order to withstand such an enormous pressure with a proper factor of safety the cast-iron rings would have to be so excessively thick, if the diameter is maintained, that the weight of rings destined for such depths would exceed that of the water displaced. There would consequently be no buoyancy but a net dead weight. This creates a great problem in connection with the support of an immense length of lining. It is proposed to meet this in a novel manner. It will readily be understood that if we construct a double lining and introduce compressed air, for example, between the two shells, we may naturally reduce the effective pressure of water on the outside of the outer shell. Thus, if the water has a pressure of 850 pounds per square inch, we may render this, in effect, only 400 pounds by introducing an air pressure of 450 pounds in the opposite direction. By making use of this artifice, it is proposed to render possible the reduction of the thickness of metal wall. The outer shell is first let down and then the inner one. The air pressure is, of course, unnecessary until the vicinity of heavy hydrostatic pressure is approached.

APPARATUS EXHIBITED AT THE EXPOSITION OF THE FRENCH SOCIETY OF PHYSICS.

(*Continued from page 299.*)

of a little turbine, by which mercury is pumped from the bottom of a cylindrical reservoir and is returned in the form of horizontal jets, which strike against vertical blades distributed around the cylinder. The whole apparatus is filled with illuminating gas, which acts as an insulator and also prevents the mercury from being oxidized by the sparks formed on breaking contact. The turbine is driven by a little electric motor, which is keyed on the same shaft and is operated by a 4-volt accumulator. This interrupter offers the advantages of great volume of current, rapidity of interruption, regularity of operation, and permanence of contact surfaces, and it does not necessitate the disagreeable manipulations which are required in the use of petroleum or alcohol interrupters. By means of two pairs of terminals it is possible to produce a normal current and a spark of the usual character, or a very strong current and a thick and exceedingly powerful spark. The latter arrangement, in combination with apparatus of high frequency, produces electric effluvia, or brush discharges, of great intensity, while, in combination with suitable Roentgen tubes, it yields instantaneous radiographs of hands, arms, legs, and other objects of moderate thickness.

One of the photographs shows a set of instruments for wireless telegraphy. At

(*Continued on page 306.*)

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Sieve, J. McDaniel	971,770
Sifter, ash, R. H. Burke	971,825
Sifter, flour, C. Andrews, Jr.	971,875

(Continued from page 305.)

the left is the tuned resonator of the transmitting station, beside which is seen a condenser composed of alternate sheets of copper and glass, immersed in petroleum, and a spark gap inclosed in a box which diminishes the noise of the oscillating discharges. This is followed by an accumulator connected with a voltmeter. The electrolytic detector is shown near the transmitting key upon which the operator's hand rests, and the operator is equipped with a head telephone in order to exhibit the transmitting and receiving apparatus in a single photograph. The voltmeter is provided with three sliding contacts, one of which serves for regulating the voltage supplied by the battery of accumulators or galvanic cells and another for regulating the voltage received by the detector. The third sliding contact is connected with the antenna and is used for the introduction of an inductance coil. The "hygienic" head telephone is provided with disks of felt which diminish the effects both of extraneous sounds and of the pressure exerted upon the head by the apparatus.

The dygograph, devised by Dunoyer for the correction of ships' compasses, is too technical to be described here. As its name implies, it traces "dygograms" of curves, the importance of which in nautical problems has been demonstrated by Commander Guyon.

Nor shall we stop to describe Richard's improvements in the construction of barometers and anemometers, Estanave's stereoscopic projecting lantern (which has already been noticed in the SCIENTIFIC AMERICAN), or Nachet's new micrometer focusing screw for microscopes.

We will conclude this review with the description of a few interesting electrical instruments designed for medical use. Roycourt's universal electro-therapeutic apparatus with automatic connections requires a monophase alternating current, but Durand's electromagnetic apparatus with variable field may be used on a circuit of any character and is adapted to all therapeutic uses, from the most delicate diagnosis to the electrolytic employment of very powerful currents. It is based on the principle that the voltage produced by a magneto-electric machine rotating with constant velocity depends solely upon the strength of the magnetic field, which can be varied easily by moving the magnet toward, or away from, the rotating armature. If, on the contrary, the magnet remains fixed relatively to the armature, the voltage depends solely upon the velocity of rotation.

In the accompanying diagram of Durand's apparatus, *A* denotes the field magnet, *I* the rotating armature, *M* an electric motor which drives the armature and is connected with it by an elastic coupling, and *R* a rheostat by which the speed of the motor and the armature can be varied. The magnet *A* rests on balls which roll on two parallel rails, so that it can be moved without appreciable friction. The photograph shows the magnet in one of its extreme positions, which gives a very small voltage. In the other extreme position the magnet entirely surrounds the armature and the voltage attains its maximum value, 100 to 110 volts. Any desired voltage between these limits can be obtained, easily and accurately, by moving the lever *L*, connected with the magnet. The current is collected by brushes and conducted to the terminals *PP*. A flywheel attached to the armature shaft, a milliamperemeter *Ma*, and an electrolytic condenser *Go* complete the apparatus. The flywheel is of such size that the armature current does not vanish for several seconds after the motor circuit has been broken, so that a momentary interruption of the motor current is scarcely perceived by the patient. In some of these instruments the armature coil is subdivided into several sections provided with independent collector rings and brushes (1, 2, 3, 4 in

the diagram) by means of which a monophase or triphase undulating current can be obtained, as may be desired.

In this connection it should be noted that the Ancel universal induction coil can be employed, in conjunction with a petroleum condenser and an Oudin resonator, for all medical applications of high-frequency currents. One of the accompanying photographs shows this combination of apparatus, with the exception of the induction coil.

A Safe Set Screw.

The States of Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, New Jersey, Ohio, Oregon, New York, Pennsylvania, Washington, and Nevada have all of them passed laws in which the dangers that attend the use of set screws in machinery are so far recognized that factory proprietors are required to provide suitable guards which will prevent injury from set screws. Mr. Edgar T. Davis, a factory inspector of Illinois, has stated that in the year 1906, 100 men were killed or crippled for life in Illinois factories, by the set screw alone. Assuming that the same proportion of accidents to population holds good for the entire United States, it would follow that about 1,500 people are yearly killed or maimed in the United States by set screws alone. Is it any wonder that most of our legislatures have condemned the set screw in the laws which they have passed, and that in some foreign countries the use of set screws is absolutely prohibited?

There are two ways of preventing the set screw from maiming and killing. One of them is to provide a guard in which the rotating part carrying the set screw revolves, the other is to sink the head of the set screw flush with the particular piece of metal into which it is screwed. Obviously, the latter method is the simpler and the cheaper of the two. Exactly how set screws shall be sunk flush with the members into which they thread has been a problem that has engaged the attention of inventors ever since nations began to realize that something should be done to protect the lives of workingmen. It has been found difficult, however, to make a set screw which is sufficiently strong to resist the strains to which it is subjected, so that it will not break off and necessitate expensive reaming, stoppage of machinery, loss of time and money. Hence, however willing they may be to protect the men in their employ, factory and machine shop proprietors have not looked kindly upon the flush-head set screw.

We have lately had our attention called to a new form of flush-head set screw invented by Mr. W. G. Allen, in which the old objection of lack of strength is completely removed. The screws are of many types, of any length, and of any diameter. They are threaded for their entire length or for part of their length only, by either rolled or cut threads. They have a substantial body portion, with sufficient metal to insure strong threads. The hexagonal socket in the head is surrounded by a substantial body of metal, the socket being designed to receive a key or crank wrench for turning the screw in and out of its hole. The peculiar process of manufacture employed is such that the screws are rapidly produced with polygonal sockets in the head end without redrawing to increase their length. They can be made from ordinary round bars in such a manner that the threads are perfectly formed in a body that has sufficient metal to be strong and substantial. The key or crank wrench can be inserted in the socket for turning the screw in or out without danger of breaking head ends of the screws.

Hollow-head set screws which have been commonly employed and which have proven too weak, are ordinarily made of sheet steel. Mr. Allen's screw is made from bar steel of any desired thickness. The method used for manufacturing these set screws can also be adapted to the manufacture of cap screws, as well as slotted screws.

OUR AVIATION NUMBER

On October 22, 1910, there will be an international aviation meeting at Belmont Park, New York, the most important that has ever been held, either in this country or abroad.

Tens of thousands of people who never saw a flying machine in the air will attend that meeting. The newspapers will publish articles and pictures about the men who are flying.

The SCIENTIFIC AMERICAN, will be the only paper in which the inquiring reader who wants to know how flying machines fly, why they differ in type, why they are constructed as they are, will find just the information he wants. For the SCIENTIFIC AMERICAN will issue a special aviation number with a colored cover, bearing date October 22d, to commemorate this highly important international event.

The number will be nearly twice as large as the regular SCIENTIFIC AMERICAN. It will be packed with instructive and thrilling pictures of the leading types of aeroplanes in existence to-day.

Among the articles will be descriptions of the leading types of machines illustrated with carefully prepared wash drawings in which every part of the machine is lettered so that its construction and operation can be understood at a glance; an article on the flying machine of the future, accompanied by an illustration in which the probable appearance of the machine which the racing man of ten or fifteen years hence will use, if we have correctly interpreted the present tendencies in construction; an article on learning how to fly, in which the methods of the French aviators and constructors are described, as well as the new machines which have been devised just for the purpose of teaching a man how to fly. The difficult art of flight is set forth lucidly, and the various means of maintaining stability (wing-warping, ailerons, etc.) are described. There will be a brief history of the art of aviation, in which credit is given where credit is due.

The number will be published primarily in the interest of people who want to know enough about flying machines to understand their construction and operation without delving through dull technical articles.

Simplicity of expression, heightened by picturesqueness of presentation, will characterize this number.

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